THE MODEL ENGINEER

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A MINIATURE SPRAY GUN ● REPAIRING TOOTHED WHEELS

MARCH 4th 1954
Vol. 110 No. 2734

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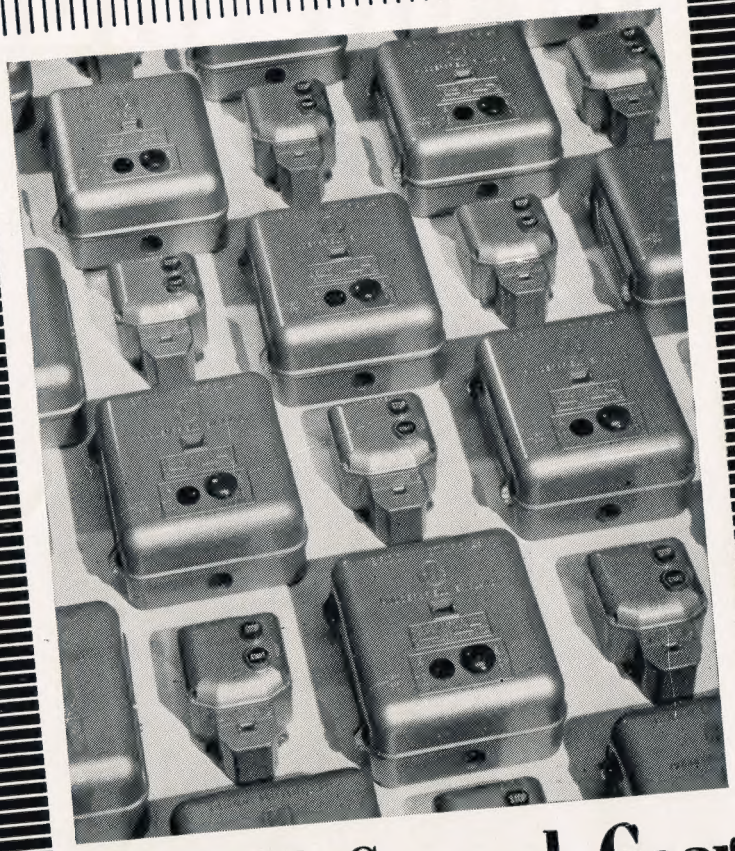

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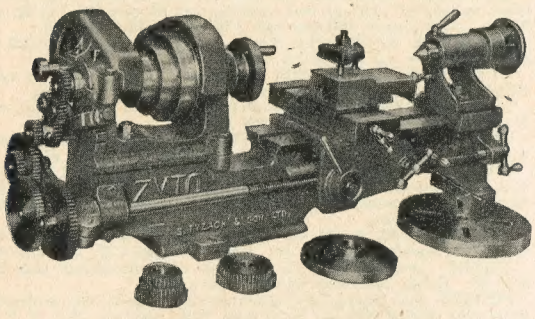

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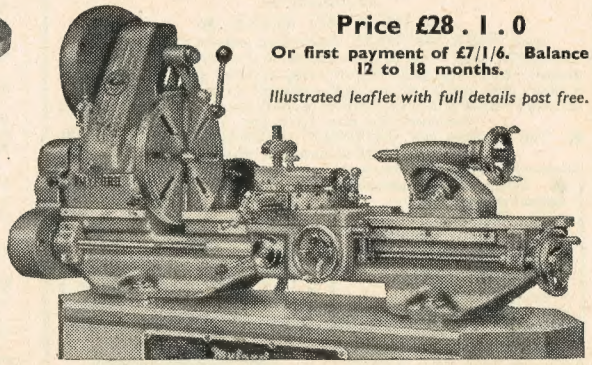

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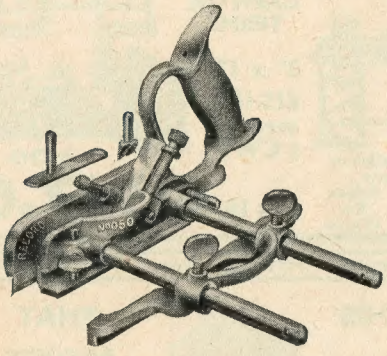

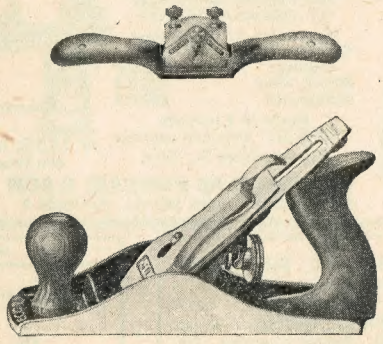

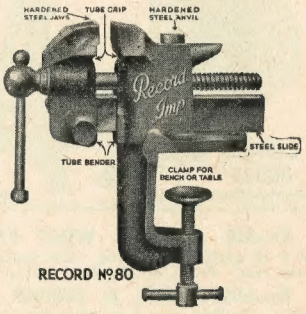

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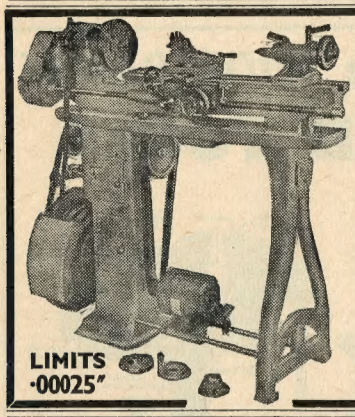

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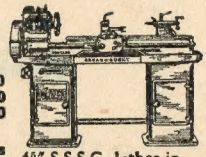

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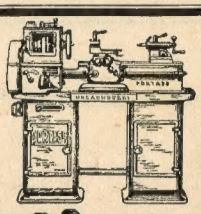

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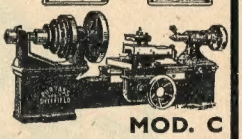

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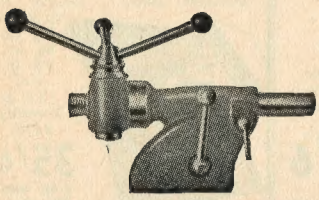

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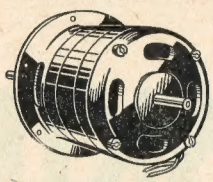

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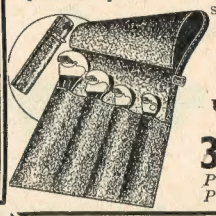

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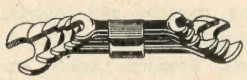

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THE MODEL ENGINEER

EVERY THURSDAY

Volume 110 - No. 2754

MARCH 4th - 1954

ESTABLISHED 1898

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Our Cover Picture

The old song says "All the nice girls love a Sailor" and it is generally admitted that sailors, as a class, are fond of the girls, as well as being fond of their ships. Our photograph seems to us to illustrate very pleasantly all three interests. The model which is of an American barquentine is certainly a very fine piece of work, and the pleasure of the old sailor in making it is very obvious from his expression and concentration. Model making as a hobby is one of the finest ways of keeping the mind alert and the fingers active with advancing age, and ship models are usually appreciated as a decorative feature in the home. The one in our photograph would add character to any room, provided the room was large enough.

SMOKE RINGS

Baghdad Trade Fair, 1954

THE BOARD of Trade is anxious to arrange a display of representative British models in the British Section of the Baghdad Trade Fair, which will be open from October 25th to November 8th, 1954. We have offered to forward to the Board particulars of models of any modern prototype, or design, the owners of which would be willing to lend them for the purpose. All freight and insurance charges will be borne by the Board of Trade.

It seems that here is an excellent and unusual opportunity for British model engineers to help in publicising their hobby in a country that probably knows little at all about it. Models exemplifying modern engineering practice will be preferred because of the possibility of the inhabitants of Baghdad being misled by old-time locomotives, traction engines and the like, into thinking that Britain is out-of-date in outlook !

Anyone willing to help in this scheme is requested to send details in the first instance and as soon as possible to : The Manager, THE MODEL ENGINEER Exhibition, 19-20, Noel Street, London, W.1.

Another Andover Rally

MR. R. PEMBLE, the hon. secretary of the Andover and District Model Engineering Society, has written to say that, in spite of the great disappointment experienced last year, there will be another Traction Engine Rally this year. It will be held on May 1st, and through the kind interest and generosity of Mr. N. Dance, the site will be Finkley Farm, which is three miles north-east of Andover. It is marked on Ordnance Sheet No. 168, reference 384486. There will be a display of models in a marquee on the field, and refreshment and car park facilities will be provided.

Mr. Pemble expects a larger entry of engines this year, and he thinks the weather will have to be very bad to prevent the programme being carried through on such a field. The later date should ensure better weather conditions than last year.

Any further announcements regarding this event will be published in our "Club" page as they come to hand.

Mr. F. Hardstone

IT IS with much regret, that we record the death on January 16th, of Mr. F. Hardstone. In 1938, Mr. Hardstone won the Championship Cup, Locomotive section, with his magnificent 2½-in. gauge 4-8-4 "Northern" type express locomotive, which was described in the "M.E." for November 17th of that year. This beautiful job, remarkable for the completeness of detail and extreme precision of workmanship in every part, created quite a sensation at the time, and it won several high awards at exhibitions subsequently held in various parts of the country. Mr. Hardstone was a determined and indefatigable model maker, as is clear from the fact that, because of the impossibility of obtaining fully-detailed drawings for this engine, he spent some months in making his own for another type of engine. Then he succeeded in acquiring a set of drawings of the Joslin *Uranus*, which he preferred to the one he had started on; he carefully studied them to see if the parts he had already made could be used on *Uranus*, but as the prospect of this was not encouraging, he prepared an entirely new set of drawings to his own design and embodying as many details as possible from the earlier drawings. Construction of the engine occupied approximately the next five years, but the reward for all this industry was the unfeigned admiration of model engineers throughout the land.

Model engineering has lost a staunch devotee, and we know that many of our readers will join us in sincere sympathy with Mr. Hardstone's family in their bereavement.

Arrival at Land's End

"End to End" by Steam Car

JOHN O'GROATS TO LAND'S END IN 1900

By St. John C. Nixon

THE long journey from "End-to-End" has, to my knowledge, only once been performed on a steam-driven car. It was completed by an old and close friend of mine, the late Hubert W. Egerton (the founder of Mann Egerton and Co. Ltd.), whose full description of this trip, which was both perilous, and exhausting almost past belief, lies before me as I write. Egerton passed away some two years ago, and my respect for him can be gauged from the fact that it was he who first taught me to drive a motor car in January 1900—precisely 54 years ago. He was indeed a dear fellow, and I cannot do better than give his account of this great adventure, in the depth of winter, in his own words:

"The most adventurous journey I ever made was from John O'Groats to Land's End in mid-winter, ending on December 23rd, 1900, at the Land's End Hotel, eight days before the close of last century. This journey was done on the really rather joy-like locomobile steam car built in America. The vertical boiler was 14 in. in diameter and approximately the same height and was fitted with 300 one-half-inch bore copper tubes; the shell of the boiler owed its strength chiefly to the several layers of steel pianoforte wire which were wound round it. One could raise steam in about five minutes from lighting up, but the trouble was that it would consume much more steam than it could produce, at anything like the speed desirable, so that a burst of speed had to be followed by a long wait until the pressure was restored again (normal working pressure was 250 lb. to the square inch).

"To drive a locomobile steam car was a very wearisome business because of the enormous number of things one had to perform before one could start, and at the conclusion of each stage of 20 miles, and finally before one could put it away for the night! One consumed rather more than a gallon of water per mile, which meant that I had to pick up, pour into the tank and evaporate, over five tons weight of water on the "End-to-End" journey of 900 miles. If one had to dump the fire and go in search of water, one had to improvise a fire on the roadside in order to heat a device known as the torch which, when red-hot and connected to the petrol supply pipe, supplied the heat required to vaporise the petrol when starting from cold.

Lubrication Problem

"Pressure of 70 lb. to the petrol tank had to be supplied by an ordinary tyre pump vigorously applied at frequent intervals. To oil the engine, one had to take an oil can, such as is used on a sewing machine, and lubricate: Each of the two ball-bearing big-ends; each of the two main bearings; each pair of slide bars and cross-head; each pair of ball-bearing eccentrics; central driving chain and sprocket; various smaller mechanisms such as the lever driven from the cross-head which operated the somewhat inadequate water pump.

"I had only driven a steam car for less than 300 miles when I became convinced that this oiling arrangement was hopeless. I therefore rigged up a brass tank holding about a gallon of oil, into the bottom of which I fitted six taps which I could turn on and off, through which oil could be squirted into the path travelled by the big-ends as they revolved in the open. Fully 90 per cent. of this oil went straight on to the road, but the odd ten per cent. did useful work.

As regards petrol consumption, I was assured by the chief engineer of the Locomobile Company that I could rely on 16 m.p.g., so being a canny soul, I based my calculations on exactly half this, and even then, I had the mortification of running out of petrol on one occasion and had to do the worst part of the journey absolutely alone, as I sent my assistant forward by train to fix up supplies. This terrible journey over the Grampians in the dark, I shall never forget.

"I refused absolutely to undertake the trip on the miserable single-tube tyres fitted. They were of the hosepipe variety, and these I exchanged for Dunlops which gave no trouble at all.

Breakdown

"I think it was somewhere near Preston that we heard ominous noises coming from the rear axle, which proved to be a broken cup and balls in the outside main bearing of the near-side rear wheel. I found that I had omitted to bring with me a special tool for removing a broken cup, and so was faced with the alternative of giving up the expedition or going on *without the ball-bearing*.

"I decided on the latter, so after

'bunging' the axle-tube full of grease, I replaced the wheel and tried to forget all about it; had I examined the axle, I would probably not have proceeded more than another mile or so! For approximately 600 miles the axle revolved on the edge of the damaged cup, and when we arrived home, the axle was rather more than half cut through.

"Both of us suffered severely from exposure to long periods of the intense cold, and at one point, I had to dismantle the fire-box and fit a new burner, which occupied several hours by the road-side, in the teeth of a blizzard.

"Brake Consumption"

"As regards brakes, I caused much mirth at the Locomobile factory when I demanded *three* spare brake bands; the last of my spares gave out before entering Cornwall and from that point onwards, I had to rely solely on the reversing lever which needed very careful handling to avoid snapping the one driving chain. This was not much bigger than an ordinary cycle chain and was shockingly inadequate for the work it had to perform. I took several spare chains with me, but I used up all my supply.

"It was very anxious work descending steep hills in pitch darkness and knowing that if the chain *did* snap, nothing could prevent the car running away. This was the worst of the whole trip, and I shall never forget the sense of relief from strain which came with the dawn, and the knowledge that we were approaching the end of our journey.

"One other trouble which beset me all through the long trip was caused by the failure of the cross-head-driven water pump to supply the water to the boiler in sufficient quantities. I had foreseen this and so had cut a slot in the floor-boards and had fixed the handle of the auxiliary hand-pump in such a position that I could work it as I drove along. As the hours of darkness wore on, on this eleventh and last night of our adventure, I was finding it more and more difficult to keep awake. At about 3 a.m. I realised that I must take a rest or face the almost certain risk of falling asleep.

"I tried everything to shake off the deadly drowsiness, but I was forced to shut off steam and sleep for ten minutes. After my companion had woken me up, I got down from my lofty driving seat and plunged my head into a stream of icy water at the roadside, which had an immediate effect. After covering the last part of the journey from Penzance, and arriving at Land's End, I went in search of a photographer, and some of the photographs shown are the result. Our daily average was about 75 miles, and I cannot find words to describe the hardships we suffered, owing largely to the weather which was the worst experienced in Scotland for a great many years."

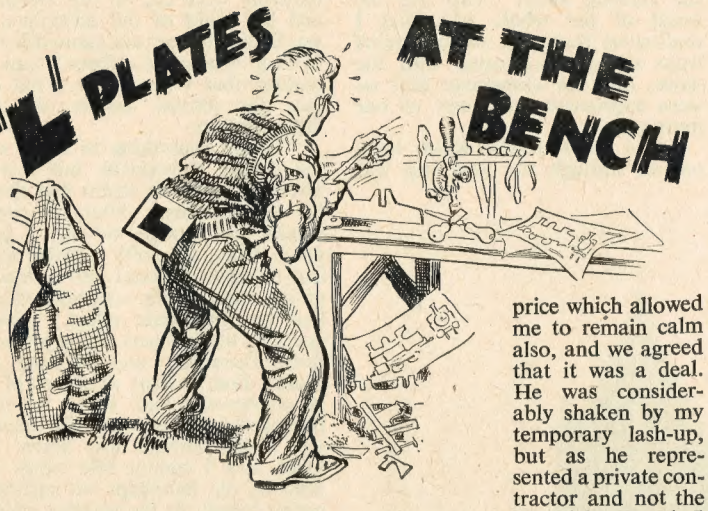
That is Egerton's story of this remarkable adventure. The "End-to-End" journey has never been repeated on a steam car, as far as I know. One amusing fact remains to be told. A day or two after his return to London, I received the following post-card from him:

"From End to End I've been at last,
and home again once more,
And now I have a chance to
sleep, by Gad but won't I snore!
Some trouble I have had of
course and often used the oiler,
But in spite of all, my dear old
boy, I've never bust the boiler."

The start from John O' Groats

Right: After it was all over

L PLATES AT THE BENCH



The Chronicle of a Model Engineer in search of Skill and Experience

By "Cadet"

ONE of my problems, you may remember, was whether to put more windows in the workshop, or block up the existing small one and have a bigger and better lighting system. As quite a lot of my workshop time is during darkness, I finally decided to have all artificial lighting.

So out came paper and pencil, and I got to work sketching out wiring systems. After a lot of paper had been torn up and much use made of the india-rubber, what finally came out of the wash was as follows:

(1) Fluorescent strips over each of the two benches. There seem to be two schools of thought on whether this type of lighting is a good thing over moving machinery. I'm going to give it a trial and if later on I don't like it, out it will come.

(2) An entirely independent "pilot" centre light, working from a switch on the workshop doorpost. This will cut out groping around in the dark for various switches.

(3) A distribution board placed centrally over the main bench, carrying two 15 amp. and two 5 amp sockets; two switched bayonet-type lampholders threaded on brass bushes, switches for the fluorescent strips and a mains switch so that on leaving the shop, all current except the centre light can be switched off.

A Calm Atmosphere

I put this up to the man who came to give an estimate and he took it quite calmly, added up a few mysterious signs and gave me a price which allowed me to remain calm also, and we agreed that it was a deal. He was considerably shaken by my temporary lash-up, but as he represented a private contractor and not the Electricity Board, I couldn't have cared less. I assured him that during the late European disturbance a lot of expensive services apparatus had operated very successfully on wiring of that sort.

Came the day when the electrician arrived complete with case of tools, coils of cable and lengths of conduit to install *the system*. He dumped his impedimenta in the workshop, opened his case of tools, spread a few things about, and then disappeared into the kitchen for a "cuppa." That was his first mistake. It so happened, that particular day, that daughter Felicity Jane and son Leigh were playing a very complicated game involving carrying buckets of lawn-mower cuttings about the place and creating a miniature Stonehenge in grass.

When Sparks got back to the workshop he found that somebody had emptied several buckets of grass into his open toolcase—not very dry grass either. Of course, no one had the faintest idea how it could have happened, and there were volunteers aplenty to help him to sort things out. A merry time was had by all, with father footing the bill at Lord-knows-how-much an hour. However, all was eventually adjusted, a short, sharp lecture given to the more junior members of the family, and work commenced. One thing became apparent almost at once; you may have noticed that the favourite symbol of those who publicise electricity is a flash? That symbol had no relationship whatsoever to our Sparks. I had to issue strict instructions in the

"*believe me, brothers, not unpaid*"

Continued from page 136, *February* 4, 1954.

kitchen that he was to be rationed to tea mid-morning and mid-afternoon only; even then progress was so slow it just was not visible. At such times as I was about the place I had to force myself to go away and concentrate on something else, because my hand kept wandering towards the mallet hanging so temptingly just over the bench. . . .

But even snails and nationalised cross-country trains get there in the end, and the time came when I tried all the sockets and switches, found somewhat to my astonishment that they worked, and our hero packed his little toolcase and departed, unhonoured and unsung, maybe, but believe me, brothers, not unpaid.

A Start on " Tich "

It was at this point that I got the itch, badly, to get on with making something. The position was that there was no prospect of a lathe for some little time, but having secured what the estate agent might well term " commodious premises," I wanted to get the place humming with activity without further delay. I did not have to think long about what I was going to make, either, because I had had it mentally pigeon-holed for some time. The subject was " L.B.S.C.'s " *Tich*. This seemed to me to fill the bill admirably because it is the simplest one the maestro has turned out. Any spoiled bits would not be too expensive to replace and yet, when brought to a successful conclusion, it would do its stuff round the garden in approved fashion. Fair enough; and as a first step, out came the back numbers of THE MODEL ENGINEER and the series was tracked down to 1949.

Just to reassure myself that I was not about to bite off the unchewable, I re-read the first two or three instalments and was much cheered by so doing; I could make it, I felt sure. I sent off for the necessary bits and pieces and watched the post until the package arrived, a routine known to most of us not living near a supplier. The postman having eventually done his stuff, I retired to the workshop, dragged my seat (an inverted tea-chest) up to the bench and got down to it.

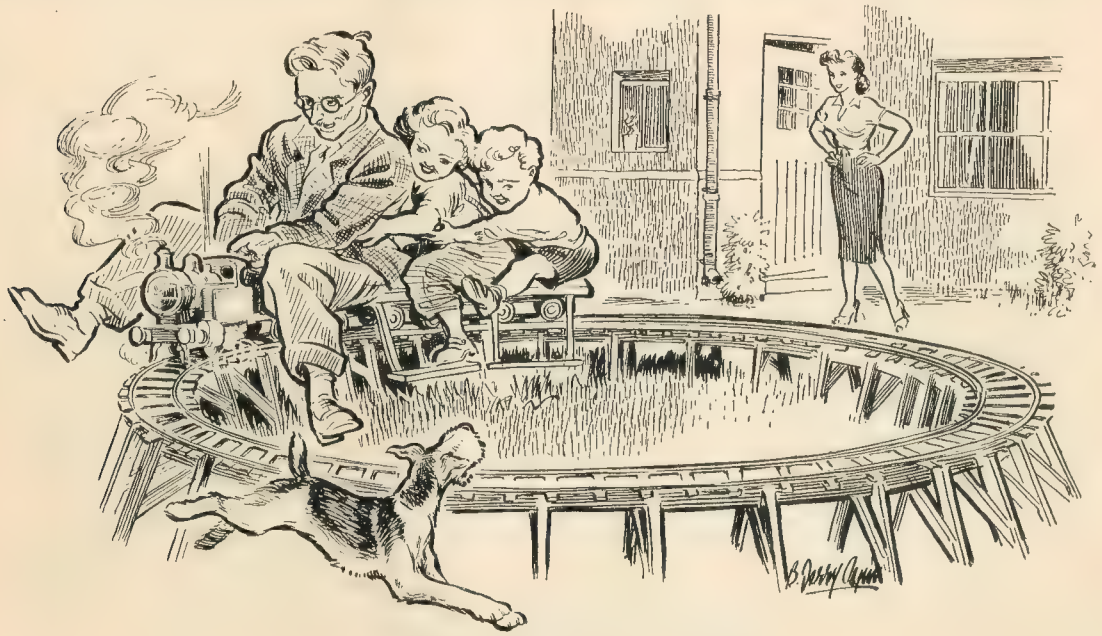
Our mutual friend, under the sub-heading " How to Mark Out the Frames," said, " as easy a job as ever was, " and he must be right because even under the point of my scriber it went like a charm although I had to watch myself when it came to marking the vertical centre-line of the cylinders and I had to be very, very careful about the " aheads " and " behinds " when working from the vertical lines; I would have found " port " and " starboard " rather more familiar. However, on went the lines and then centre-pops and never a boob. . . .

I haven't a bench shear, so had to rivet the plates together and cut out with the hacksaw. I had one of the spiral-type blades in the frame and decided to use that. It went through the metal as though it were cheese, but what a job to keep it anywhere near the scribed lines ! The trouble is, of course, that where the ordinary blade will cut in only one direction unless the frame be turned, this thing is just as happy cutting sideways as downwards, and every little wobble of the hand is immediately transmitted to the line you are cutting. However, there was no damage that could not be adjusted by the tactful use of the file. Incidentally, I did not follow the advice to use the vice jaws as a sawing guide, in view of the fact that I was using the spiral blade, and if you take my advice, you won't either under similar circumstances. New steel jaws for a vice are prone to come expensive !

Drilling

Mention of wobble reminds me that as my present drilling equipment consists of a hand brace, I had to keep plenty steady while putting through the No. 40's and during the opening-out processes. I find that once the drill is turning, even moving the neck to ease the crick is unwise ! However, by resisting the temptation to shift the feet and taking care not to breath too deeply, a reasonable hole can be made.

I did not have much trouble with



" do its stuff round the garden in approved fashion "

" still filing when due to retire "

the buffer beams either, although I had to turn the drawing round and round several times before taking out the $\frac{5}{8}$ in. pieces at either end; I expect it was because I was being rather dim, but I did not find the " top and underside " view too easy to sort out. The slots were cut by the " utility " method, i.e. two blades side by side in the hack-saw, and I found that this worked very well indeed, but when it came to the filing I found that I did not have a flat file sufficiently thin. It was Saturday evening, no shops would be open until Monday, and I was anxious to get on.

My solution will probably cause a few snorts around Purley way, but it worked, so who cares ? I remember that in a certain lady's beauty " tool box " there was one of those nail files, about a foot long and tapered all the way along its length—quite a sturdy job. First applying a cautious ear to the lounge door to make sure the radio was on full steam. I sneaked rapidly upstairs and in no time at all I was back in the workshop filing away. The tool did the job very well. I've never seen it in use on nails, and I'll take jolly good care I'm not around if ever it is brought out for that purpose, because frankly, after my little experiment with it, I do not think the operation would be a success.

Age and Patience

I found the angles for frame attachment a fiddling job when it came to getting the " nicely squared ends " with hand filing, but the main requisite, apart from care, seemed to be patience, and I'm getting more of that as I get older. The next job I am going to tackle is the hornblocks, and if hot-pressed alloys are at all obtainable, I'm going to track them down. So far, this job is getting rather too much like the Army course in engineering, in the course of which, I am told, the student starts learning how to use a file on the first day, and is still filing when due to retire as a full general !

Well, that's progress to date—a workshop that is beginning to look businesslike and something on the bench taking shape. Although there is a long way to go before " skill " is acquired, at least I'm making a start.

(To be continued)

Drawings of " Thetford Town "

WE have received a set of drawings for the 2-in. scale Burrell double-crank compound showman's road locomotive, *Thetford Town*, designed by Ronald H. Clark. The set comprises sixteen sheets and covers every detail required for the construction of a first-class working replica of the well-known prototype. The fitting of a crane is, to some extent, optional in a model primarily intended to work ; but most of the prototypes were supplied with this feature, so full details of it are given in these remarkable drawings.

It is more than apparent that a very great deal of research, care and industry has been expended on the original drawings, the prints of which are excellent. The makers' drawings of the full-size engine have been closely followed ; but it is obvious that in a *working* model some departures from the design and construction of the prototype must be made, notably in the boiler, cylinder-block and wheels, unless the working capabilities of the model are to be a secondary consideration and the construction made more complicated. These drawings, however, show clearly the modifications that have been made, as well as the prototype construction ; so the model maker can decide for himself which to follow. But whichever course is followed, the model is, in all external visible details, a faithful reproduction of its prototype. The modified details have been prepared in collaboration with Mr. Dick Simmonds, of the well-known Erith firm, whose long experience of the needs of model engineers everywhere has been of considerable value in this matter.

The last sheet of the series, No. 16, is a general arrangement of the engine, in side and end elevations, full size for the model. It is available either as a plain print, or colour-washed as an aid to painting the model, full details of the Burrell style of painting the prototypes being given on the print.

In our opinion, this set of drawings is exemplary and very reasonably priced. The whole set of 16 sheets, including the plain g.a. drawing, costs £4 10s. 0d. post paid ; with the g.a. drawing flat-washed in colour, the price is £6 7s. 6d., post paid. Sheets 1 to 15 are 6s. 6d. each, postage 3d. extra ; sheet 16, plain is 10s. 0d., or coloured, 40s. 0d., post paid.

MORE UTILITY STEAM ENGINES

A Double Tangye Type Mill Engine

By Edgar T. Westbury

THE eccentric sheaves for this engine can be made in the same way as that of the " Unicorn " engine, but as they have no bosses, and consequently are short in the bore, in relation to diameter, special care must be taken to ensure that the bore is parallel with the main axis, and also a good fit on the shaft. As an alternative to the recommended method of setting over the blanks for boring, they may, if desired, be finished all over on the outside and parted off, then clamped to the faceplate for boring; make sure that in each case the outer face, which was machined at the same setting as the bearing surface, is placed in contact with the faceplate, to eliminate risk of error, in case the other face is not perfectly true. The normal lathe faceplate has too large a hole in the centre to enable the sheave to be bolted directly to it, so that a parallel packing plate of flat steel or other available metal must be interposed. It is a good policy to set this up by itself, and bore a shallow recess in it to fit the rim of the sheave; then after setting it over the required amount, it may be fixed independently to the faceplate, apart from whatever method is used to clamp the sheave. In this way it is possible to ensure that the two sheaves, or indeed any number one may have to produce, have exactly the same throw.

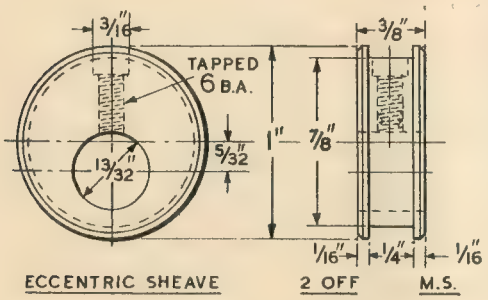
The hole for the fixing screw is drilled through the thickest part of the sheave, and is counterbored to enable a headed screw to be used, instead of the usual headless grub-screw, which is difficult to tighten adequately. If a standard 6-B.A. cheese head screw is used, it will be found necessary to turn the head down slightly to enable it to enter the $\frac{3}{16}$ in. counterbore; needless to say, the head must not project above the bearing surface, and thus the face may have to be machined back slightly as well, or alternatively, the counterbore depth increased. It would be possible to use a socket-head Allen type screw here, but as this will make an incised " footprint " in the shaft, it should not be fully tightened until the precise setting of the sheave has finally been determined.

Continued from page 183, *February* 18, 1954.

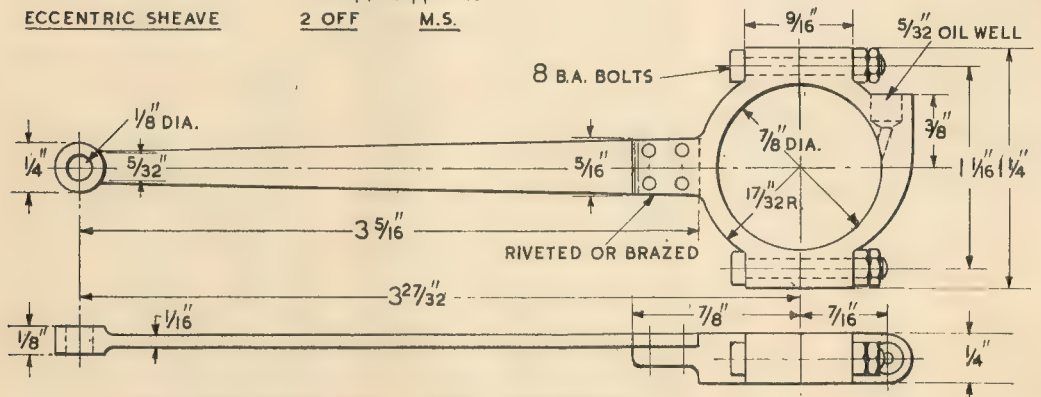
Eccentric-rod and Strap

In Mr. Ballantyne's version of this design, the rod is of flat section, and attached sideways to the strap, in a manner which is quite common in model locomotives, but which I have never seen employed in a full-size stationary or marine engine. I am, however, following this de ign, as it is a perfectly satisfactory method from a functional point of view; it may, however, be modified if desired, using either a flat or round section rod, with a foot to bolt against the edge of the strap, as in the "Unicorn" engine. One of the single Tangye models I have seen has a tapered rod of round section, with the end shouldered down and screwed into a socket on the strap; but I have found no precedent for this method of attachment.

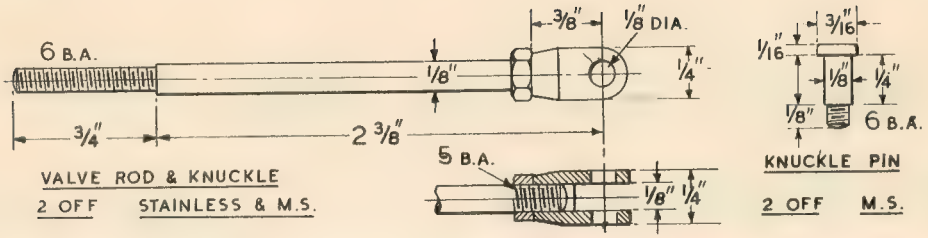
The split straps may be machined by the same methods as that of the " Unicorn " engine, each strap being individually fitted to its sheave so as to work freely but without shake either way. The lug for attaching the rod may be milled or filed, parallel with the side faces;



ECCENTRIC SHEAVE 2 OFF M.S.



ECCENTRIC ROD & STRAP 2 OFF M.S. & BRONZE



if it is filed, this operation can be simplified by taking a facing cut on the lug, while the job is set up for boring, as far as allowed by the shoulder. It will then only be necessary to file out the corner to allow the end of the rod to fit snugly in position.

If the rod is to be brazed on, this should be done before the finishing operations on the bore and sides of the strap are carried out, as there is more than a possibility that the heating may cause distortion, even when relatively low-temperature silver-solder is employed. The rod should be held in place by at least one pin or rivet during the operation. To reduce risk of distortion, soft-soldering is permissible as an alternative, the simplest method being to coat the surfaces with Fryolux, Entocene (or any other of the popular "solder paints"), pin the parts together, and heat up over a bunsen burner till the solder melts, when they should be firmly pressed together and left to cool. In the absence of either brazing or soldering, I advise using four 1/32-in. rivets as indicated on the drawing; they may be flush-fitted to simplify cleaning up operations.

The knuckle end eye of the rod is widened to provide a good bearing surface for the pin, and to avoid the necessity for machining the whole length of the rod on both sides, it will be more convenient to attach the boss. Mr. Ballantyne recommended brazing washers on each side of the flat strip, but I would prefer to turn up a boss to the dimensions shown, with an undersize centre hole, then cut a 1/16-in. slot half-way through it to take the rod a tight push fit, and braze in position; soft solder in this case would be hardly good enough. The length of the rod between centres is not critical, as the slide valve position can be adjusted on assembly by the lock-nuts.

Valve-rods

These are turned down at one end and screwed 6-B.A. to take the lock-nuts, the other end being screwed 5 B.A. and fitted with a knuckle, which can be made in the same way as that for the "Unicorn" engine. It will be seen that mild-steel is specified for the rod, and as I have explained, this is quite satisfactory as a general rule, though stainless-steel will be better, precluding all risk of trouble through rust, if the engine is laid up for long periods. One of my engines has piston and valve-rods made of German silver, which has worn well over a period of years, and is also, of course, immune to corrosion.

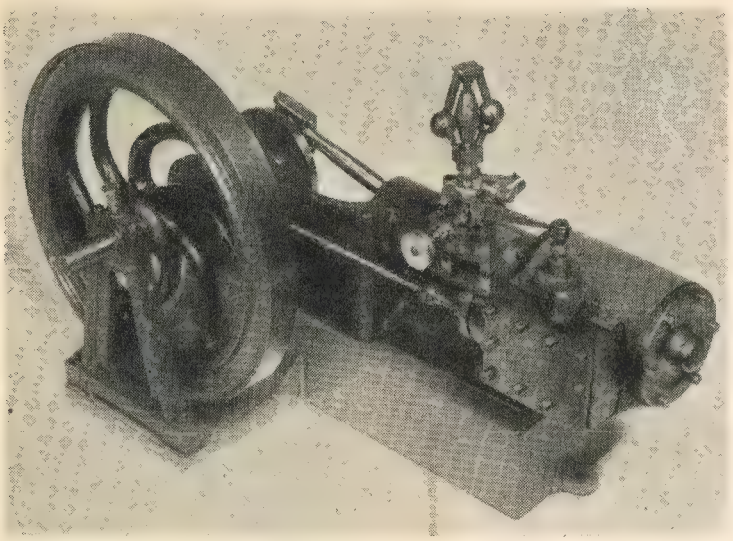
Some of my readers appear to confuse stainless-steel with silver-steel, but of course these materials are quite different, and the latter, though (apparently) slightly more resistant to corrosion than mild-steel, does not qualify for the adjective "stainless." Silver-steel is very useful for many purposes, but it has disadvantages for structural or working parts of engines, and I do not recommend it as a rule

Governor Gear

The type of governor specified for this particular model is one which was fairly popular in steam engine practice for many years, but it is somewhat more complex in construction than that of the "Unicorn" engine, and if my own experience in these matters is any guide, rather more difficult to get to work properly in a small size. It may be mentioned that many of the Tangye mill engines employed a governing system known as "Johnson's patent," in which the mechanical working parts were more like those of the "Unicorn" governor, though their mode of operation in controlling the engine was totally different; instead of throttling the steam, they controlled the cut-off of the slide valve. In this way, greater advantage of the expansive property of the steam was utilised at low and moderate loads, and economy thereby improved. This idea, of course, was by no means exclusive to Tangye engines; there were dozens of patent governors designed to make the most of expansive working, by such devices as linking up, altering eccentric timing or throw, and also through the operation of special forms of valves, not necessarily of the sliding type.

While any of these methods can be, and many have been, adopted in models, they very much complicate construction, and are not always entirely satisfactory when called upon to perform according to rule; as I have pointed out, it is always a good policy to keep these mechanisms as simple as possible to reduce working friction. Throttle governors have advantages in this respect, and are by no means without precedent in quite large engines; one of the double engines in Tangye's 1892 catalogue had twin governors and throttle valves quite comparable in appearance with those shown here, though more complicated in detail, and not quite in the same position. One difference in the governor itself was that in place of a return spring of the compression type between the top and bottom yokes, it had a hollow weight of double-conical form, resting on the lower yoke and loose on the vertical spindle. While quite effective for its purpose in a large engine, this method is unsuitable for a model; it would be quite impossible to accommodate, in the available space, sufficient weight to overcome the friction of the control gear—not even if one made the sliding weight out of frozen mercury! Hence the use of the spring, which does not look so neat as the weight—but does its job.

The action of the governor should be self-evident, but may be reviewed briefly to preclude any possible misunderstanding. In common with that of the "Unicorn," and indeed with nearly all engine governors of the period, it is driven by belt from the engine shaft, through the medium of bevel gears. At the top of the vertical shaft, a yoke is fixed, from which the swinging weights are suspended by pivot pins, and stirrup links from the centres of the weights connect them to a lower yoke which is free to slide up the rod, against the force exerted by the weight or spring. This yoke also incorporates



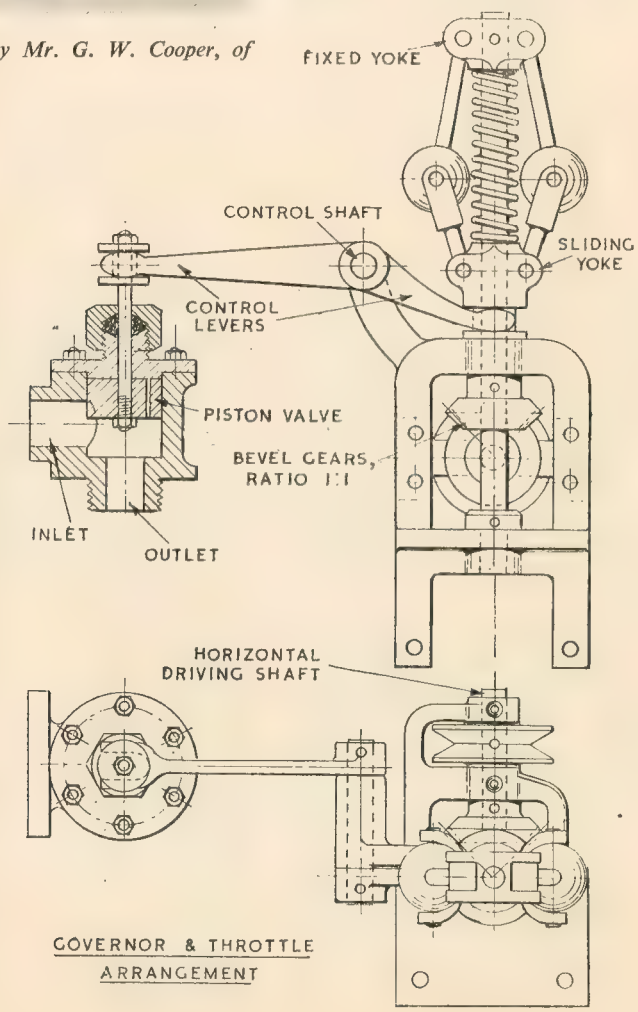
A single-cylinder Tangye engine model loaned by Mr. G. W. Cooper, of Framlingham

a collar which controls the motion of levers connected to the throttle valve.

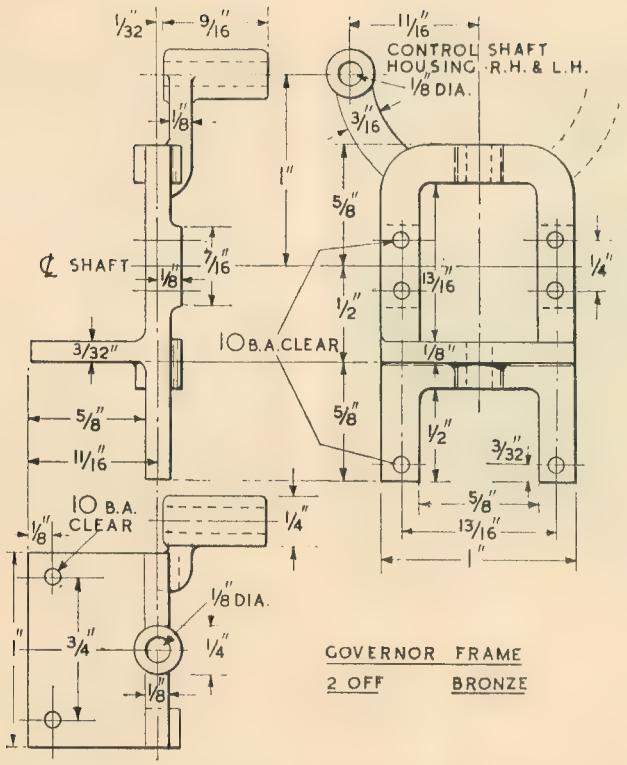
When the governor spindle and its assembly rotates, centrifugal force tends to cause the weights to fly outwards, thereby lifting the lower yoke through the stirrup links, as soon as the effect of this force overcomes that of the weight or spring. This results in the depression of the piston valve inside the throttle casing, thereby reducing the area of the steam engine passage, and restricting the supply of steam to the engine. In a well-designed governing system, a balance of forces is arrived at in which the amount of control movement is just sufficient to keep the speed constant within fairly close limits; no governor can possibly be 100 per cent. perfect, but it has been possible to keep the speed within about one or two per cent. of that specified by means of an ordinary centrifugal governor. Assuming reasonably good design, the most serious obstacle to accurate governing is friction in the working parts, which often causes them to move "in lumps," and thereby cause "hunting" or alternate rise and fall of speed, sometimes to an excessive and even dangerous extent.

It is my opinion that the throttle valves specified for this engine, being of the piston type, would be more difficult to operate smoothly than the rotating plug type of valve as used on the "Unicorn" engine, assuming the same quality of workmanship in each case. It is always much easier to rotate a spindle in a gland than to push it bodily through endwise, and moreover, the leverage on the rotating spindle may readily be modified by altering the length of the control arm on the spindle. The piston-valve, unless it is of elaborate type with ports all round to distribute the pressure, is liable to be forced to one side, and thus cause still more friction.

The throttle-governed types of full-size Tangye engines employed multi-ported piston valves, and Mr. Ballantyne apparently copied the external appearance of the valve housings, but with single-port piston valves inside; presumably he was able to make them work fairly satisfactorily, so I have adhered to his design in essential principles. There is, however, one small refinement I have added, by drilling a



GOVERNOR & THROTTLE ARRANGEMENT



hole through the piston-valve to balance the pressure on the upper and lower surfaces. In the absence of this provision, there is a risk of the valve becoming locked, or at least retarded, by differences of pressure, and though it might be argued that the trapped air for steam on the upper side might help to steady the motion by acting as a dashpot, I do not think this could be relied upon to give consistent results. Incidentally, the piston-valves used in the full-size engines were hollow, and this question, therefore, did not arise.

Governor Frame

This is most conveniently produced from a bronze casting, and if it is provided with a chucking piece on the upper boss, may be held in the three-jaw chuck for drilling the spindle bearings. See that the outer boss runs as true as possible, and after centre-drilling it very carefully, run through a drill, about No. 35 or 7/64 in. diameter. If this is continued through to the inner boss, it will probably run out of truth to a greater or less extent; to avoid this risk, enter the next larger number size drill, which should be a close fit in the outer boss, and thus guide the point more effectively. Enlarge the holes with a No. 31 drill, and finish with a $\frac{1}{8}$-in. reamer or D-bit.

The inner and outer faces of both bosses should be as square and true as possible, and as the former cannot be reached with an ordinary facing cutter, it is worth while to make a special hollow cutter to mount on a $\frac{1}{8}$-in. rod, and short enough to go in the available space. It is possible to hold the housing of the control shaft bearing in the three-jaw chuck for centre-drilling, drilling and reaming to $\frac{1}{8}$ in. diameter; note that this boss is "handed" right and left for the two governor frames.

Little further machining work is necessary on this casting: the underside of the mounting platform and the inside of the vertical legs can be trued up with a file, and the same treatment is sufficient for the side facings to which the horizontal shaft brackets are attached; but they may be milled if the means for doing so are readily available. To assist in checking the parallelism of the facing with the vertical-shaft axis, a $\frac{1}{8}$-in. rod may be inserted in the bearings, and parallel slips placed against this to indicate the true plane of the surfaces.

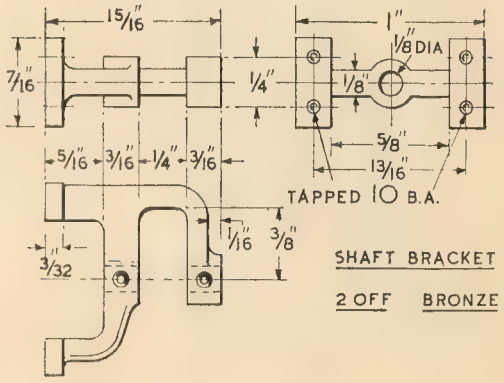
Shaft Bracket

The casting for this component may also be equipped with a chucking piece to enable the housing to be held in the chuck for drilling the shaft bearing, in exactly the same manner as the vertical shaft, taking the same care to ensure that the drill goes through truly. At the same setting, the feet of the bracket can be faced off to seat truly on the facings of the frame, and the front end of the bearing boss also faced. After removing from the chuck, the inner sides of the bearings may be faced with a hollow cutter mounted on a $\frac{1}{8}$-in. mandrel, as described for the previous component. For jobs of this nature, I use a three-toothed cutter with teeth on both sides, right- and left-handed respectively; this takes little longer to make, and saves time in use, as it enables both sides to be faced without having to remove the mandrel and reverse the cutter.

Instead of setting up these two castings in the lathe for drilling the bearings, some constructors may think it simpler to mark out both ends of the housings and drill them in the drilling machine, or against the back centre of the lathe, relying on the reamer to correct any slight error in alignment of the two holes. This method is quite all right if you can get away with it.

The bracket is attached to the governor frame by four 10 B.A. studs and nuts, the holes being first drilled in the frame and spotted through on the feet of the bracket.

(To be continued)



L.B.S.C.'s Lobby Chat

IT'S NEVER TOO LATE!

YOUNGER readers of these notes would be surprised if they knew how many "boys of the old brigade" are keen and enthusiastic locomotive builders. Time and time again, I receive a letter from a new correspondent, who maybe asks a query or two; and then adds that although he is a novice on the job, he is really old in years, perhaps over sixty, in an apologetic sort of manner. Bless their hearts and souls, there is nothing to be ashamed of, in making a late start! We old-timers are only too glad to welcome them to our ranks. I wouldn't be at all surprised to find, that if a census were taken, it would be found that the later middle-aged, and the elderly, were more numerous than the younger members of our fraternity. In our early days, the steam locomotive was the fastest thing on wheels—apart from a few experimental jobs, the only internal-combustion engines were stationary engines driven by gas or oil, and the only things in the air, were birds and balloons—and the steam locomotive became dear to our hearts; a love that has never died. Nowadays, most youngsters look on our favourite as old-fashioned and out-of-date, not bearing the slightest comparison to a jet airliner or a racing car. Personally, I wouldn't go a step out of my way, to look at either!

There are many real old veterans among the ranks of the locomotive lovers; and the reproduced photograph shows a real "Peter Pan," in the person of Alf Pinnock, who celebrated his eighty-second birthday on January 5th last. He is one of the most active members of the North London S.M.E., never misses a meeting, and is always ready to help at any function, such as an exhibition or something similar. All last summer, when the club members were putting up the concrete work for their permanent track at Arkley, he was right there on the job; and during the past winter, never failed to turn up at the club workshop, to help in the assembly of the rails.

The post of club librarian fell vacant; "Peter Pan" promptly took on the job! He is a very keen locomotive enthusiast, and has built a 3½-in. gauge *Iris*, to the instructions given in these notes. I can personally vouch for the quality of the workmanship, and the performance of the engine, for he has been here and run her on my own road. He also has a locomotive of the same vintage as my old *Ancient Lights*, over sixty years old, which he has rebuilt and fitted with a *Juliet* boiler, so he calls her *Romeo*! The thing which is puzzling him at the moment, is what to build next, so I have suggested the *Titfield Thunderbolt*; a worthy engine to suit an old-timer. In the picture, he is driving Mr. Arden Marchant's *Tich*, on his own line; the photograph was taken by friend Marchant. Many happy returns of January 5th last, "Peter Pan," and I hope we shall both see that *Tit* doing the job on my road, as well as your *Iris* did it!

A very good way of keeping young!

Ditto Repeato

By the same token, as Pat would remark, it is rather late in the day for your humble servant to make alterations and additions to a workshop; but it is the unexpected that always happens. Now, many of my correspondents own Myford lathes; and they often ask if I can give detailed instructions for doing certain turning, boring, and drilling operations on that particular make. As practically all of my instructions are based on actual personal experience, and as—up to recently—I had never used a Myford lathe, I could only give general directions for doing the various jobs. It was of no use my describing how to set up a job and machine it on a Milnes, or Drummond, when such machines were no longer procurable; and as my shop was "full up to the whistle," it didn't appear as though any lathe of another make would ever be installed. Yet Fate willed otherwise!

In my dissertation on lathes that would, and wouldn't, be suitable for locomotive-building, in the issue of December 31st last, I mentioned that the managing director of the Myford Co. had visited me, and brought some drawings and specifications of the firm's latest production. Well, when he looked around my shop, and saw what lathes I had, he said: "Wot—no Myford? I'll send you one." And he did! To make room for it, I decided to let the Drummond go, and Driver Syd Herbert, of Faversham shed, now has it, so it's still "in the family." Not only that, but still in sight of a Southern main line; as what was the L.C. & D.R. main line,

passes the bottom of his garden. Bro. Myford said that the machine would be complete with stand and motor, so I altered some of my shop wiring, and put in a special plug for "juice."

When the machine arrived, I nearly fainted. It was a Super-Seven, assembled complete, plus nearly all the blobs and gadgets in the accessories list. I thought the lorry-driver was never going to quit carrying parcels in! Bro. Myford himself, and friend Reeves of "Baernegum," came along soon after the lorry arrived, got the machine in, installed it, connected up, and saw that everything was O.K. Well, it's late in life for an old —ah, um! dog to start learning new tricks; but I'm going to test out Bro. Myford's production against the type R Milnes for heavy work, and against the Boley for light precision work. It has already passed my test, at time of writing, for fits and accuracy, with flying colours; and I'm pretty "hot," as I did a bit of precision-lathe testing when on the munition job in the Kaiser's war.

If all goes well, I shall, in the very near future, be able to tell Myford lathe owners how I do the job on their own make of machine.

Sharp Edges not Needed

In my specifications for locomotive frame plates, soft mild-steel, either bright or blue, is called for. Several readers have complained that the soft mild-steel supplied by our approved advertisers, is not square at the edges, but appears to have been sheared, leaving one edge slightly rounded. Another complaint is, that flat rolled steel with bright finish, is hard and springy, with the result that as soon as the hornblock openings are cut, the plate goes all shapes; not only wavy, but sometimes takes a lengthwise curve. Isn't it possible to get the bright steel in a soft ductile grade that won't distort, but yet has sharp edges?

The trouble is, just like in most things, you can't have it all ways; and my honest advice is, to use the soft ductile stuff, and not bother about the sheared edge, or else buy the steel wider than needed for the particular frame, and either mill or file the rounded edge, to obtain the desired "square cut." I've used the sheared edge untouched, on several of my own locomotives, life being too short to bother about a detail which didn't affect the efficiency in the least, and was invisible when the engine was standing on her wheels, the slightly-rounded edge being on the inside. The stuff I used was, of course, perfectly flat; it is a different matter if the steel has been sheared by blunt cutters, which leave the edge with a distinct turn-up. Curiously enough, I've just received a letter from a Kentish reader who has been supplied with some frame steel which is slightly turned up on both edges; and he says, as it is the third lot of steel which he has purchased, and both previous lots were imperfect, he thought of using ground flat stock, as a last resort. Personally, I don't think it is worth the expense, as frames for *Tich* can be cut from a bit of 3/32-in. sheet steel.

The only thing to be done with a pair of frames that have been cut from the hard-rolled bright steel, and have distorted, is to anneal them, and either run them through a set of rollers, or try to iron out the waves by careful hammering; and be mighty careful to avoid using the same kind of material in future! Readers who are starting on the 3½-in. gauge *Netta* may have noticed that while the overall depth of the frames at the cylinder end, is 2⅞ in. I specified using 3 in. in the instructions, which allows a margin for squaring up the edges.

Port Cutting by Gang Mills

Just recently I received another tale of woe from a reader who departed from the "words and music" with disastrous results; "never again," says he! Our repentant brother was machining up the cylinders for a *Juliet*. Incidentally, when friend Reeves called here recently, he mentioned that he had sold over a thousand sets of castings and parts for that little 3½-in. gauge four-wheeler; a striking confirmation of my recent dissertation on the popularity of a simple 3½-in. gauge job, inexpensive in cost, and easy and quick to build, as compared with a 5-in. gauge 4-6-2 or similar. I have received photographs of *Juliets* built all over the world, and in many guises. Well, our friend duly bored his cylinders, faced the ends, and machined up the fixing flanges and the port faces; and was about to cut his ports, when the "wise person who knows all the answers" at the local club, told him he would save time, and make a far better job, if he cut his ports by a method which has been recommended for stationary and marine engines, viz.: using three small mills mounted on a single spindle. We used this method for cutting long parallel slots on old-type aircraft engine parts, at the munition shop in the Kaiser's war. I personally set up plenty of the cutters for the girls. We called it gang-milling.

Our friend listened to the advice, and duly set up his cutters as advised, mounting the cylinder on a vertical slide, and feeding it on to the gang of cutters, until it touched the spindle. On taking the cylinder out of the lathe, and examining the portface, he was pleased to see that there were three apparently perfect and clean-cut ports; so he went ahead and did the other one in two wags of a dog's tail. The next job was to drill the passages; and remembering my instructions about setting the casting on the slant, in a machine-vice on the table of the drilling-machine, and sighting the drill on the outside of it, to ensure it entering the port below the face, he tried this. Then came the great disillusionment! Those apparently lovely clean ports were a delusion and a snare, being boat-shaped, varying from "zero" depth at each end, to a little under ⅛ in. in the middle. How on earth he was going to get three steamways to enter the port at a safe distance below the portface, he didn't exactly know.

However, he was a trier, and thought that if he got the middle one right, he could manage to gauge the others, so he drilled the middle one, and the drill broke into the port with half its diameter above the curved bottom, and the other half cutting into the solid metal. This wasn't too bad. But alas! to cut a long story short, he found that when drilling the other two, the drill broke into the portface. It was then that he made his recantation, and wrote to me, humbly asking what he could do about it, as at the moment he couldn't afford fresh castings.

Saving the Situation!

He said that he had thought of trying to fill up the holes with silver-solder, and then chip the ports deep enough, with a hand chisel, to allow the passageways to be drilled as per instructions, but asked my advice first, to avoid any more trouble. I told him not to try any silver-soldering, as the heat would distort his casting, but to drive a piece of brass rod tightly into each hole, full length, and sweat it over with solder where it broke through the portface. The heat of this operation wouldn't hurt his machining of the bore and flanges. He could then carefully re-machine the portface, taking about 1/64 in. off the whole surface. That would settle the "break-through."

For deepening the ports, I suggested that he followed out my

instructions for end-milling ports with a dental burr or a home-made slot drill, starting from one end of his shallow depressions, and finishing at the other end. The end-mill or slot drill had to be a little less in width, than the gang-milled ports, so as to leave their edges intact. After deepening, the passageways could then be drilled according to instructions. This was done, and the job panned out O.K. All's well that ends well, says the old saw; but an appalling amount of time was wasted, and a lot of absolutely unnecessary work entailed, simply by disregarding the instructions which I carefully set out for the very purpose of making things easy, and ensuring "guaranteed results." In all probability, the person who advised our friend to deviate, had never cut a set of ports, or drilled the passageways, in a locomotive cylinder, otherwise he would have known that his recommended method was unsuitable. Nuff sed !

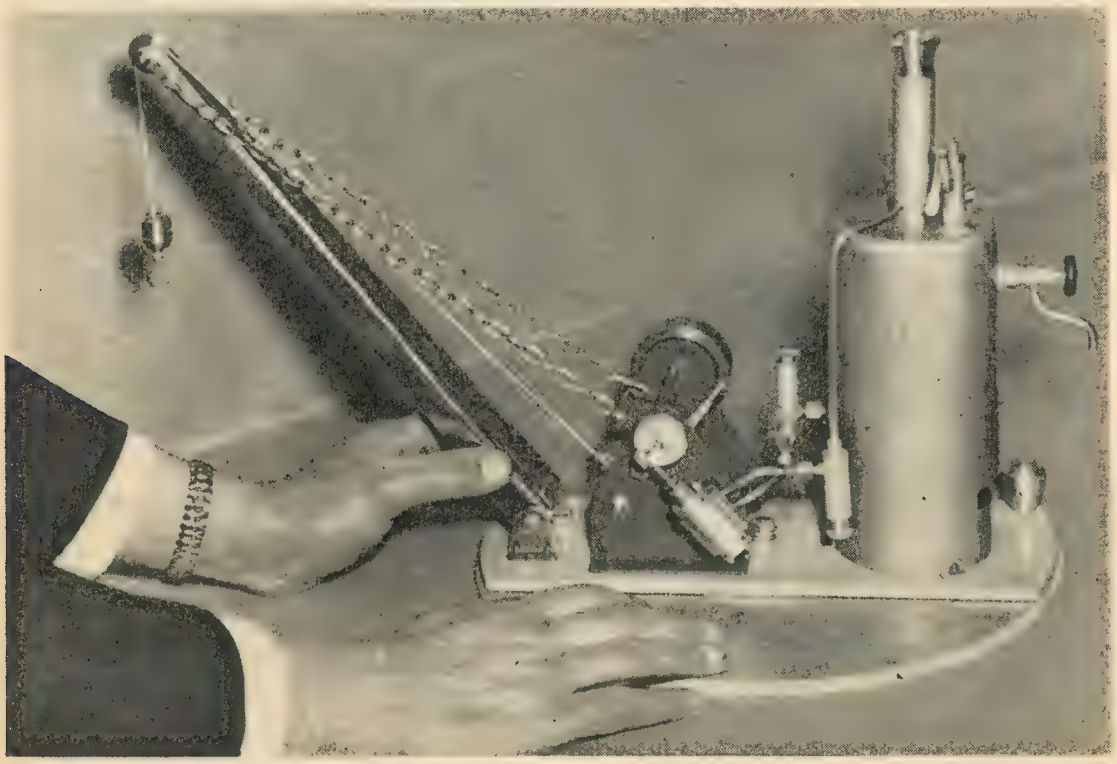
Steam Cranes Galore

From correspondence received, it appears that Santa Claus carried a good consignment of steam cranes to various destinations last Christmas; there must have been a vast amount of hoisting and lowering going on, and the crane-drivers weren't all kiddies, either—though they were young enough in spirit ! I have received several photographs of the finished machines, and glowing reports of their lifting prowess. One builder had to replace the wooden base by a slab of steel, $\frac{1}{4}$ in. thick, to prevent overbalancing through consistent overload. It makes your humble servant feel cheerful, to know that the design was appreciated, and easily carried out; and if any reader has an idea as to what would be popular for the next one, don't be afraid to sing out loud !

Take Heed !

Commenting some time ago on another writer's variation of a boiler design which I tried and discarded over 30 years ago, I mentioned that difficulty would be encountered when trying to bronze-weld unriveted joints of the type specified, due to the effects of expansion and contraction. In confirmation, I referred to notes on how to deal with these stresses, in both the B.O.C. handbook on "Copper and Bronze Welding," and the S.I.F. quarterly journal "Sif-Tips."

By coincidence, in the latest issue of the latter, just received at time of writing, there is a short illustrated article dealing with this very subject, entitled "Be Prepared for Expansion and Contraction." One paragraph reads, "The welding operator should remember that the forces of expansion and contraction are so great, that he cannot prevent them, but he can control them. In fact, they must be controlled and understood before a good sound welding job can be done." I'd just like to bring that quotation, with emphasis, before any prospective blowpipe artist who fondly imagines he can stick a few bits of copper together, with butt joints and no rivets, apply his oxy-acetylene flame and bronze-welding rod to them, and produce a perfect boiler. If you want success without two kinds of tears, profit by the personal experiences of your humble servant, nuff sed !



A "Christmas Present" steam crane, built by Mr. R. Kibbey

An Electrical Overhead Drive Unit

By John D. Elam

THE illustrations depict an overhead drive which I have designed and constructed. Its chief merits are that it is self-tensioning, self-aligning, rigid triangular construction and independent of lathe drive. By reversing the motor in its cradle and the guide pulley spindle, the direction of rotation of the grinding wheel, etc., etc., can be reversed, doing away with crossed belt, in cases where a reversing switch is not fitted to motor.

My motor is mounted on a wood base, secured in position by a ½ in. bolt passing through wood base and clamped to a plate, the overall width of cradle, by a winged nut. The sizes given are those relating to the cradle I have constructed, governed by the size of my motor, which is approx. ¼ h.p.

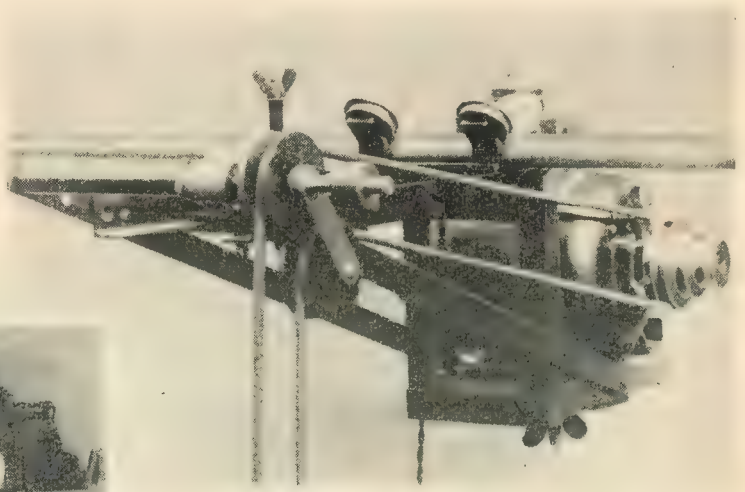
Construction is simplicity itself. Two lengths of 1 in. × ⅛ in. × 31 in. long angle-iron are required for the two side members. Mark off 9 in. along one side of angle-iron, and cut out a portion corresponding to an angle of 90 deg. If properly carried out, this leaves two equal angles of 45 deg. which when bent and closed up makes an angle of 90 deg. with base. From this point, measure 7 in., make a vertical saw cut, and bend in opposite direction to make an angle of 90 deg. Do the other length in the same manner, but remember in doing this to start the measurement of this second side in the reverse direction from the first, so that the included angles of the angle-iron face each other when ready for bracing. This completes the two sides.

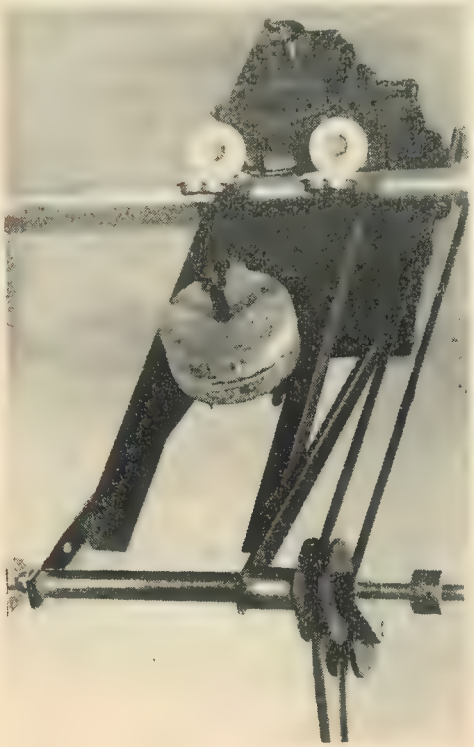
You will now require two 5¼ in. lengths of angle-iron to form braces *A* and *B*, which are riveted on the outside of cradle side members. Another length 5 in. long, *C*, is riveted on the inside, also a strip 5 in. × 2 in. × ⅛ in. is riveted at *D*, to equal thickness of angle-iron *C*, and to form a platform for angle-iron, on which one pair of ball-race brackets are fitted.

To complete cradle framework, two 28 in. × ¾ in. × 3/16 in. strips are riveted on side of cradle, as shown in the photograph and sketch, having previously drilled two or three holes in that portion of each strip which extends beyond frame.

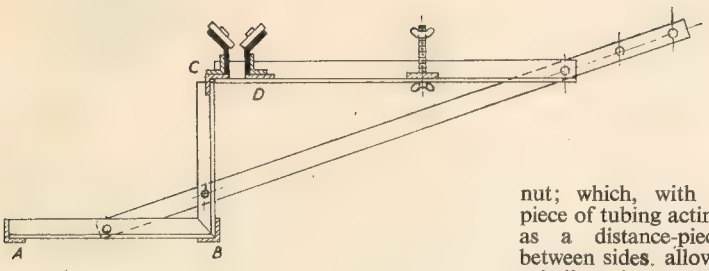
These holes should be a clearance size for ⅜-in. rod, and have ⅛ in. slots filed in same, to take the ⅛-in. pin fitted in the collar on guide-pulley spindle.

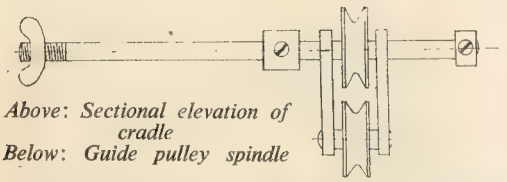
So that the whole may travel freely and keep in alignment with cutting or grinding gear, obtain four ball-bearings, and to mount them, cut off two 5 in. lengths of angle-iron and rivet to each two mild-steel brackets. These may be 1¼ in. wide and ¼ in. thick, with the top portion bent to an angle of 45 deg. The length of these brackets will depend on the size of ball-bearings, used, and the diameter of running rail, not forgetting a clearance above side of cradle. Before riveting to angle-iron, that portion bent to 45 deg. should have a ⅜ in. tapped hole, equally spaced on each bracket, so that the races may each seat together on running rail.





This view shows how the overhead drive makes a neat and compact unit
Left: View from above, showing further details





Above: *Sectional elevation of cradle*
Below: *Guide pulley spindle*

As the centre bore of ball races will probably be larger than $\frac{3}{8}$ in., one must make face bushes; an easy fit will do, just under length; then by putting a washer on each side of inner race, passing a $\frac{3}{8}$-in. bolt through and screwing into tapped hole in bracket, they will be securely held. To keep out some of the dust, I have fitted aluminium discs over top half of bearings, secured under head of retaining bolts.

One pair of bearings are fixed to angle-iron *C*, and the other to strip *D*. To help in adjusting, slots can be filed in strip *D* and secured by bolts and nuts.

To act as a counterpoise to motor, and adjust tension on belt, two strips 5 in. × 2 in. × $\frac{3}{16}$ in. are prepared. The top plate has a $\frac{3}{8}$-in. stud riveted in it centrically, the end being reduced to $\frac{5}{16}$ in. for a short distance, and fitted with a winged nut. Also riveted into this plate on each side of the $\frac{3}{8}$-in. stud, but on the reverse side, are two $\frac{1}{4}$-in. studs threaded and fitted with wing nuts. These studs pass through two clearance holes in the other plate, and clamp the two plates, which carry the counterpoise in the desired position.

The counterpoise weights are lead discs drilled for loading on $\frac{3}{8}$-in. stud, and should be of such a weight as to balance motor, etc., when approximately midway on top of cradle, when a slight movement nearer to rail will give the desired tension.

To complete the assembly, a $\frac{3}{8}$-in. rod is taken, of sufficient length to pass through side members of frame, and provide enough extension to take the $1\frac{1}{4}$ in. × $\frac{3}{4}$ in. fixed collar, pulley gear and end collar, the other end being screwed for a $\frac{3}{8}$-in. winged nut; which, with a piece of tubing acting as a distance-piece between sides, allows spindle to be securely clamped.

If motor has more than a single pulley —as mine has—enough float must be allowed for between collars.

My pulleys are made from mahogany, with bronze bushes, but it is my intention at some later period to fit these with ball-bearings, with a sliding sleeve for pulley on shaft.

If very high speeds are required, such as for internal grinding or ornamental turning, then a large diameter pulley may be fixed to motor and "tool" driven direct, with the counterpoise adjusted to overcome weight of motor, and so provide tension; or the whole cradle and motor can be reversed on running rail, which proves how adaptable the arrangement is.

The rail mentioned in my case is of 1 in. diameter bright-steel shafting, the whole being supported by the simple use of galvanised piping and Ke-Klamp fittings, of which the following will be required. Two 7 ft. 3 in. lengths, 1 in. diameter four 20 in. lengths of $\frac{3}{4}$ in. diameter piping. Two flanges for 1 in. pipe, four flanges for $\frac{3}{4}$ in. pipe, four Ke-Klamp 90 deg. 1 in. × $\frac{3}{4}$ in. crossover fittings, two $\frac{3}{4}$ in. × $\frac{3}{4}$ in. 90 deg. crossover fittings.

The two large flanges act as supports and footings for 1 in. vertical pipes; the four $\frac{3}{4}$ in. flanges are secured to wall, two near the top of 1 in. vertical tubes and two approximately level with lathe stand top.

All these fittings are supplied with Allen screws, so it is a simple matter to fit the 1 in. × $\frac{3}{4}$ in. fittings to uprights, and pass through the $\frac{3}{4}$-in. tubes, adjust and fit to flanges on wall. The two top $\frac{3}{4}$-in. tubes must have the $\frac{3}{4}$ in. × $\frac{3}{4}$ in. fitting, adjusted to take the 1 in. diameter shafting on which the carriage travels.

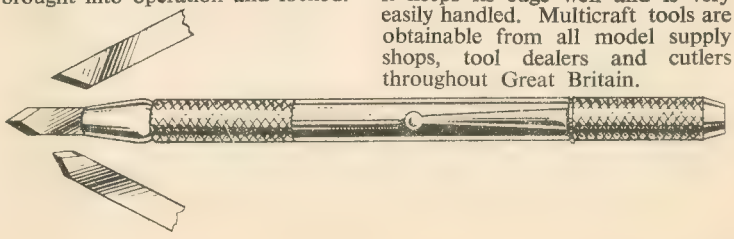
It will be noted that in my case, the floor supports the vertical tubes, but if they take their bearings from a bench, then only half the horizontal tubes and fittings will be required.

In giving sizes of pipe I have used trade terms, and it will be found that the $\frac{3}{4}$ in. fittings will pass the 1 in. diameter rail.

It will be noticed that the photograph shows a switch fitted on top of motor, but this actually is fitted for when motor is transferred to supply power to a garden sprayer, and is permanently "on" when used as overhead drive, the control being by a switch fixed to stand of lathe.

THE MULTICRAFT JUNIOR CRAFT KNIFE

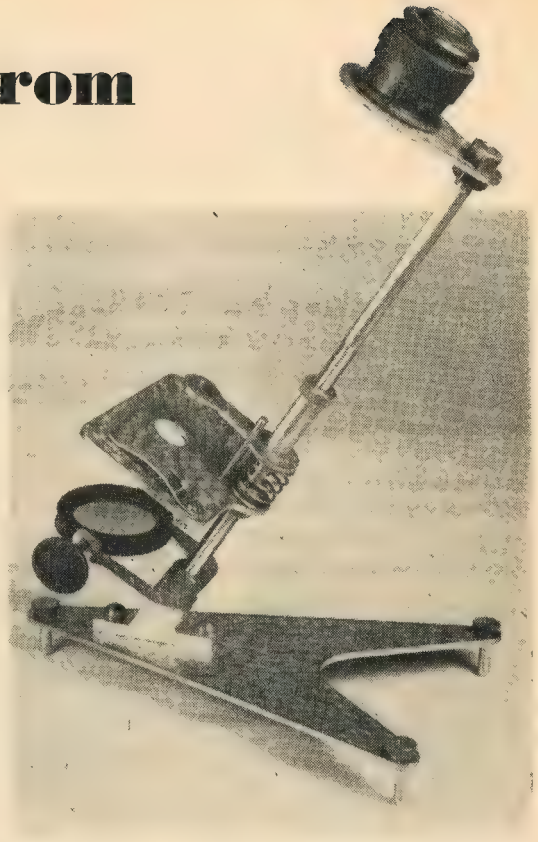
This tool is a recent addition to the well-known Multicraft range of cutting tools, which has been produced at the request of a large number of users to meet the demand for a simpler and less expensive version of the original Precision Cutter. It is light in weight and very compact, and can be carried in the pocket, a spring clip being provided for this purpose. The double-edged Sheffield steel blade is housed inside the holder, and can quickly be brought into operation and locked. When closed, the holder resembles a propelling pencil or miniature fountain pen, and is obtainable in a range of colours.



For all purposes where a handy, sharp cutting instrument is required, such as for modelling in wood or cardboard, photographic trimming and retouching, dissecting botanical specimens, etc., this knife can be recommended. We have tested a sample in our office and workshop for various purposes and find that it keeps its edge well and is very easily handled. Multicraft tools are obtainable from all model supply shops, tool dealers and cutlers throughout Great Britain.

A Microscope from the Junk Box

By W. T. Brown



THE discovery of a lens of short focal length in a small box of optical bits and pieces led me to the construction of a very cheap—but quite efficient—microscope, and as its assembly and subsequent use afforded me a certain satisfaction, a brief description and outline working details may be found of interest. The assembly is as shown on the accompanying photograph, and the stand was made from odds and ends usually found in any model engineer's junk box.

First as to the lenses. The eyepiece was taken, or borrowed, from a pair of prismatic binoculars. As a rule, one of these eyepieces is made adjustable, but either will serve. Incidentally, use cannot be made of an eyepiece taken from theatre glasses, as these are concave and useless for microscopic use. The objective is a single lens, having a clear aperture of about $\frac{1}{4}$ in. and $\frac{3}{8}$ in. focal length. This formed part of an assembly of three such lenses which could be screwed together, depending upon the degree of magnification desired. A single lens of this type can usually be purchased at an opticians for quite a modest price.

Focussing is effected by varying the distance between the eyepiece and the objective by the nut which depresses the objective against a spring which returns, or raises, the objective as the nut is unscrewed. A nut with a knurled edge turned from a piece of $\frac{3}{4}$-in. brass rod would make a more presentable finish. The actual dimensions of the stand will depend, to some extent, upon the focal length of the lenses, but, with the stand as dimensioned, the following notes will generally cover an average lens combination.

The main support is an 8 in. length of $\frac{1}{2}$ in. diameter brass rod screwed $\frac{1}{4}$ in. B.S.F. for $\frac{5}{8}$ in. at the top and for $4\frac{1}{2}$ in. at its lower end. This rod would be better if screwed $\frac{1}{2}$ in. × 40 t.p.i., which would provide a slightly more sensitive adjustment. The distance between the centre of rod and the optical axis is $1\frac{1}{4}$ in. This will normally allow clearance between the nut at the top of the rod and the flange on the eyepiece. The $1\frac{1}{4}$ in. can be increased if necessary to suit any larger diameter of eyepiece.

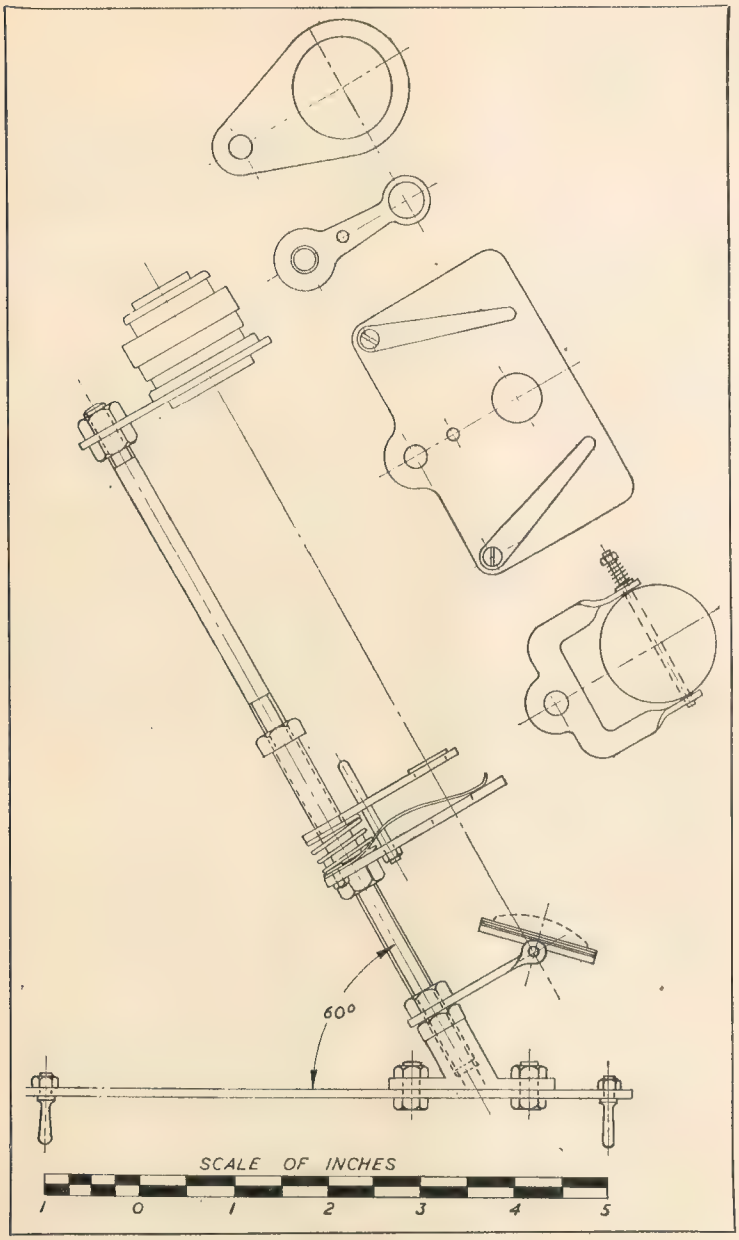
The axis is inclined at 60 deg. to the horizontal and the support-rod is connected to the baseplate by a brass socket $\frac{1}{2}$ in. wide, drilled No. 5 (0.025 in.) right through and tapped $\frac{1}{4}$ in. B.S.F. for about $\frac{1}{2}$ in. It is secured by two 2-B.A. screws with nuts underneath. The working platform is made of No. 12 gauge brass plate; all other plates are of $\frac{5}{16}$-in. brass. These thicknesses can be varied to suit any materials that may be available.

The objective plate is soldered on the underside to a 1 in. length of $\frac{1}{4}$ in. bore brass tube, to ensure that not only will the plate keep at right-angles to the main support, but also ensuring a more free travel up and down the threaded stem. It is necessary that the top of this tube is dead square and true. The objective plate should be reduced in width as much as possible, consistent with strength, to permit the maximum amount of top light to reach the object being magnified. To obviate any tendency for the objective carrier to rotate when adjusting the focus, a short length of $\frac{1}{8}$ in. diameter brass rod screwed 5 B.A. through a tapped hole in the object platform was fitted, with a reamered hole through the objective plate.

The spring, which has only to support the weight of the objective plate, lens and tube, was made from light gauge steel wire with an inside diameter of $\frac{9}{16}$ in., a free length of $\frac{3}{4}$ in. and with four free turns. Two leaf-springs are fitted to the working platform, made of spring or stainless-steel shaped as shown, $\frac{1}{4}$ in. wide × 0.025 in., their ends being secured by 6 B.A. screws tapped through the plate with locknuts under. These springs serve to hold a microscope slide in any position.

It is necessary that ample light should be available to the object being examined, as it is obvious that when a small area is enlarged, only the light over that area is available, so that there is a great decrease in intensity with increasing magnification. To obtain this extra light, a mirror is fitted as shown. This mirror is of the concave type, of short focal length, and is so placed that the rays of light converging on the object form a small spot of intense light where it is wanted. The mirror I used had a focal length of about $1\frac{1}{2}$ in. This mirror is mounted inside a stirrup-shaped plate secured between two nuts on the main stem, and with a rod across the mirror's diameter to enable it to rotate on a horizontal axis.

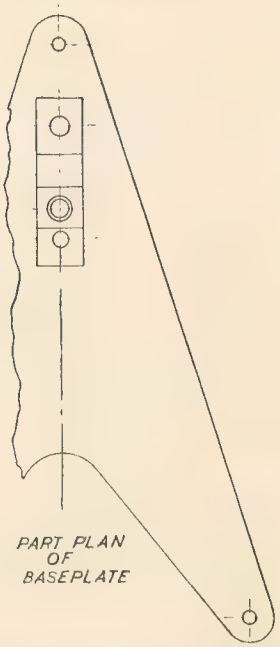
If a concave mirror is not available, a substitute can be made by using a flat mirror with a plano-convex lens secured to the face of the mirror with a spot or two of transparent medium such as Canada balsam, nail polish or the like. A



simple make-up for this mirror is to use a piece about 1¼ in diameter, secured to a similar size brass plate with adhesive. On the underside of this plate, and across its diameter, solder a brass rod extending ⅛ in. one side and about ½ in. on the other. This long end should be screwed 6 B.A., over which a light helical spring is placed, with a nut to adjust the tension. This arrangement, turning in the open jaws of the support, will retain the mirror in any position. Incidentally, the mirror shown in the photograph was taken from another instrument. It is a well made unit comprising a concave lens mounted in a light brass cell and the two knurled operating ends are screwed into the cell sides. Its construction would be far more difficult than that now suggested.

A few final comments. The distance between the eyepiece and objective can be increased to almost any extent above that shown if greater magnification is desired, and is only limited by the resolving powers of the lenses and the availability of plenty of light to the object. The distance between the object lens and the working platform is approximately the focal length of that lens.

To ascertain the focal length of a convex lens, hold it parallel to the table and vertically under a light a few feet above, and the distance from the lens to the table is its approximate focal length when the spot of light converging from the lens is at minimum size.



Check each nut to see that their bearing faces are quite flat and square to their bores. The general shape and details of assembly are not binding, and considerable latitude is permissible in the making of this microscope. As the lenses have usually screwed, spigoted ends clearing holes—or a press fit—will serve for their fitting in their supports, as they will not fall out. The three legs were fashioned from $\frac{3}{16}$-in. brass rod reduced at one end, screwed 4 B.A. and secured by nuts. A neater finish would be to tap the holes in the baseplate, thus leaving a flush top.

This microscope will at least be a source of pleasure to others besides its maker, and the only expense, provided the eyepiece is available, will be in respect of the objective and the mirror.

READERS' LETTERS

● **Letters of general interest on all subjects relating to model engineering are welcomed. A nom-de-plume may be used if desired, but the name and address of the sender must accompany the letter. The Managing Editor does not accept responsibility for the views expressed by correspondents.**

LUBRICANTS

DEAR SIR,—In your issue of December 24th, you were good enough to make reference to Microloid dry lubricant and you will be pleased to know that this has resulted in some 20/30 enquiries being received from interested readers in a very wide variety of fields, including firms of engineers, the School of Agriculture, Cambridge University, the Professor holding the Chair of Anaesthetics at Bristol University, etc., etc.

We note that later in the same issue you refer to the fact that Shell have a range of cutting oils. A number of your readers may be comparatively small users and will not wish to take a 5-gallon drum. All the oils and greases we sell are by Shell, and we specialise in the needs of the smaller consumer and would always be willing to help those who required the odd gallon.

Yours faithfully,
London, W.C.1. C. W. STEPHENSON
p.p. British Industrial Products.

TIPPED TOOLS

DEAR SIR,—Upon reading "Duplex's" notes on tipped tools and their affinity for steel, I agree. While using tipped tools for castings of all kinds, I never use them for steel.

During the last war I became acquainted with D.S.H. or to give its full name, Double Super Hydra tool-steel, manufactured by Messrs. Hall & Pickles & Co., Manchester. Since then I have used no other for steel. For speed, heavy cuts, and fine finish it has no equal, and can be sharpened at red heat if you are in a hurry.

I have never seen it mentioned in THE MODEL ENGINEER; I have no interest in the above-mentioned firm.

Yours faithfully,
Framlingham. GEO. W. COOPER.

RARE ELEMENTS!

DEAR SIR,—I see that in your issue for January 28th, there is some criticism of Mr. Oxley. As he is reported to be in no state to reply for himself, may I beg the use of your space in his defence?

Surely his claim to fame must lie in his atomic investigations, and of these the most original was undoubtedly the description of *Ughium*. However, I feel his true genius showed itself in his handling in large quantities, and at the right time, of something much older. I refer, of course, to his masterly use of *Bolonium*!

Yours faithfully,
Carshalton. G.D.

THE GLASS-CASE MODEL

DEAR SIR,—I have read the letter of Mr. K. N. Harris in the issue of THE MODEL ENGINEER of January 21st, and should now be glad if you would please allow me to comment as follows:—

During the last war, a glass-case model of a well-known L.M.S. locomotive was transferred from its site in London to Glasgow, so that it could be saved and preserved for posterity. As a favour, I was allowed unofficially to examine this and found the boiler to be made of wood. The coupled wheels had axles which were not continuous, also the piston-rods worked in holes drilled in the cylinders. A thing of beauty to behold in its glass-case, but, alas, to one who is interested in working models, this one could only be termed "a dummy."

This model may exist for posterity to view unless attacked by ants, as happened to a boiler once described by a correspondent in this journal, "The Maistri."

The foregoing is no reflection on the work of Mr. Baines. Like Mr. Harris, I have spent some time in the Science Museum admiring the excellent craftsmanship of his Stirling single; however, as the locomotive does not carry a number-plate, it may be a model of a prototype later than No. 1. I believe No. 1 had spokes of rectangular section in the driving wheels, reference the photographs and drawings in THE MODEL ENGINEER for March, 1939.

If Mr. Harris yields to none in his love for working models of the type to be seen on the track of the S.M.E.E. at the "M.E." Exhibitions, then it is suggested that he joins me and thousands more from Land's End to John O' Groats, and further afield, in raising our hats to your contributor Mr. "L.B.S.C.", without whose "words and music," the number of working models in existence would be very much less than exists today.

Mr. Harris has been unfortunate in the working models he has seen, if so many will so soon be consigned to the scrap heap. This casts a very grave reflection on everyone who has given of his time to describe in detail their working models in the pages of THE MODEL ENGINEER. The statement is also liable to scare off would-be contributors of interesting articles.

For Mr. Harris's information, he may be amazed to learn, Glasgow S.M.E. had on show in their 1946 Exhibition a working model steam engine working on compressed air which was a prize-winner at the Glasgow Working Men's Exhibition in the year 1862. The diploma granted was on display with the exhibit.

At the Scottish "M.E." Exhibition in November last there was shown a working model, hot-air engine over 100 years old. In my possession is a working model beam engine now nearing its century, which, unless the unforeseen happens, will not reach the scrap heap in my lifetime nor my son's either.

As Kipling wrote in "Macandrew's Hymn":—

"I'm sick of all their quirks and turns,
Their loves and doves and dreams.
Lord, send a man like Robert Burns
To sing the song of steam."

The prayer has been answered. Yes! thirty years ago.

In conclusion, I would suggest to Mr. Harris and any other of a like mind, in so far as the scrap-heap for present day efforts of the amateur is concerned, they read the poem of the Immortal Bard, Robert Burns, "Address to the Unco Guid."

Yours faithfully,
Glasgow. ALLAN RODGER.

HYDROCARBON VAPOUR ENGINES

DEAR SIR,—Readers who are following the "Utility Steam Engines" articles by Mr. Westbury, may be interested to know of an engine similar to the hydrocarbon vapour engines which he described in the December 17th, 1953 issue.

An engine called a " waste heat " engine was manufactured and used commercially in Germany shortly after the turn of the century, and is briefly described in a 1906 book by C. W. Berry called " Temperature Entropy Diagrams." The engine is of triple-expansion design, operated by steam in the high and intermediate pressure cylinders. The low pressure cylinder was operated by sulphur dioxide, which was evaporated in a heat exchanger by the condensing of intermediate pressure exhaust steam. Since the heat of evaporation of the sulphur dioxide is less than that of water, and occurs at a lower temperature, the heat in the exhausted condensing steam would serve to evaporate larger quantities of sulphur dioxide at about a 7 : 1 ratio, from which it gets its name. High pressure steam was at 171 psi., with superheat to 558 deg. F. The low pressure cylinder operated at 143 psi. and 134 deg. F.

These engines were built from 150 to 450 h.p. and had a pretty good steam consumption of 8.36 lb. per h.p. hr., but the expense of the equipment was too great to become commercially successful. Unfortunately, the manufacturer's name is not given.

At present I have under construction a V-4 steam engine, quite similar to that of Dr. W. W. Lacy, described in THE MODEL ENGINEER in 1952.

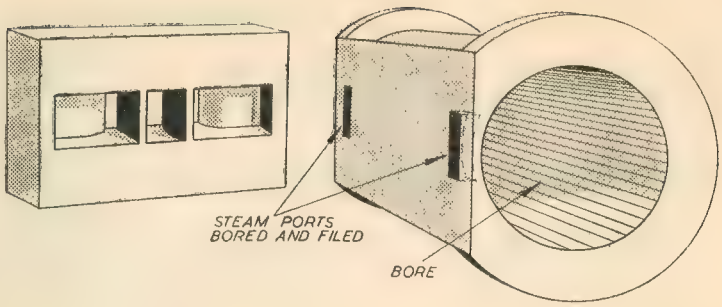
Yours faithfully,
New Baltimore. U.S.A. RALPH J. RASMUSSEN.

STEAM ENGINE CYLINDER CONSTRUCTION

DEAR SIR,—I feel sure that many keen model engineers hesitate to make a steam engine on account of the intricate pattern-making and core-boxes required, in connection with steam and exhaust ports.

Recently I had occasion to make two cylinders 3 in. and 4½ in. bore × 4 in. stroke, which were moulded and cast by a small local foundry not specialising in this type of work. The cylinders, at the same time, had to fit a Myford ML.7 lathe for the boring and facing of the flanges. This was achieved in the following manner:

The cylinder barrel was cast as per sketch, with one flat side for the reception of the separate port casting, then the usual separate steam-chest and door. The barrel casting fits easily with good balance into the 4-jaw chuck and can be bored perfectly with a stout boring bar carried in the tool holder. After facing the flat port face, it is a simple operation to bore and file out the ports, particularly as the file can be held at both ends. The port casting can be made with ports cored right through or in the case of smaller cylinders, the valve face side left to be bored and filed. Here again the file can pass right through with maximum control and speed.



Yours faithfully,
Perranporth. D. P. SADLER, A.M.I.Mech.E.

(*This method of cylinder construction has been described in past issues of* THE MODEL ENGINEER, *but it is certainly a practical device, which may be useful to many of our readers not previously familiar with it.*—ED., " *M.E.*")

LAYOUT OF STEPHENSON VALVE GEAR

DEAR SIR,—Recently I have received a letter from Mr. Keiller in which he drew my attention to an error in the tables of valve events of the G.W.R. Dean Single and of my own model, I gave in my article on Stephenson valve-gear.

The error in each case is the exhaust port opening which should read 3.25 in. and 1.95 in. for full and linked-up positions for my own model, and 2.25 in. and 1.53 in. respectively for the original engine; i.e., as the valve is line and line on the exhaust side, the opening is half the valve travel.

My apologies to you and my fellow readers of THE MODEL ENGINEER and my appreciation to Mr. Keiller for bringing the error to my notice.

Yours faithfully,
Maidenhead. D. G. WEBSTER.

DEFINING THE ENGINEER

DEAR SIR,—Re the letter in THE MODEL ENGINEER (28-1-54) " Defining an Engineer." Surely " an engineer " is a man who can carry out a job in engineering from A to Z. For instance, he should be able to examine a damaged or worn engine or machine, make sketches of new parts required, and from these make detailed drawings, as well as any patterns and castings, as may be required. He should also be able to carry out all machining, such as turning, drilling, milling, planing or slotting, and to fit and assemble the completed job.

Yours faithfully,
Sudbury. CHAS. H. TOOGOOD.

MODEL ENGINEERING IN HONG KONG

DEAR SIR,—I read in the Readers' Letters columns of THE MODEL ENGINEER that the cost of sundries for the hobby of model engineering is very high; also, that some of the readers, on going abroad sell their lathes, etc., and find the prices of new ones in their new abode are high, which is quite true in the latter case.

I have just purchased a " Hobson " 3½-in. lathe, and I am very well satisfied with it; it is the most compact unit, and by far the best machine I have used.

My advice to any readers who are contemplating a change of country is: If you have any machines, take them with you, it is worth the little expense in boxing them up. Here in Hong Kong, these items are very hard to come by, and as your readers say, very expensive. There are some Japanese machines about, but I think the little extra cost of the British products is worth while.

I must take this opportunity to express my thanks to the readers of THE MODEL ENGINEER for putting forth their views and also queries to the editor, as I have learned quite a few things from these columns.

Finally, to save any misunderstanding, I am not in any way connected with the manufacturers of the " Hobson " lathes, I am only a very satisfied customer of theirs, and, of course, THE MODEL ENGINEER.

Yours faithfully,
Hong Kong. HENRY WHITTLE.

(*Continued on page* 246)

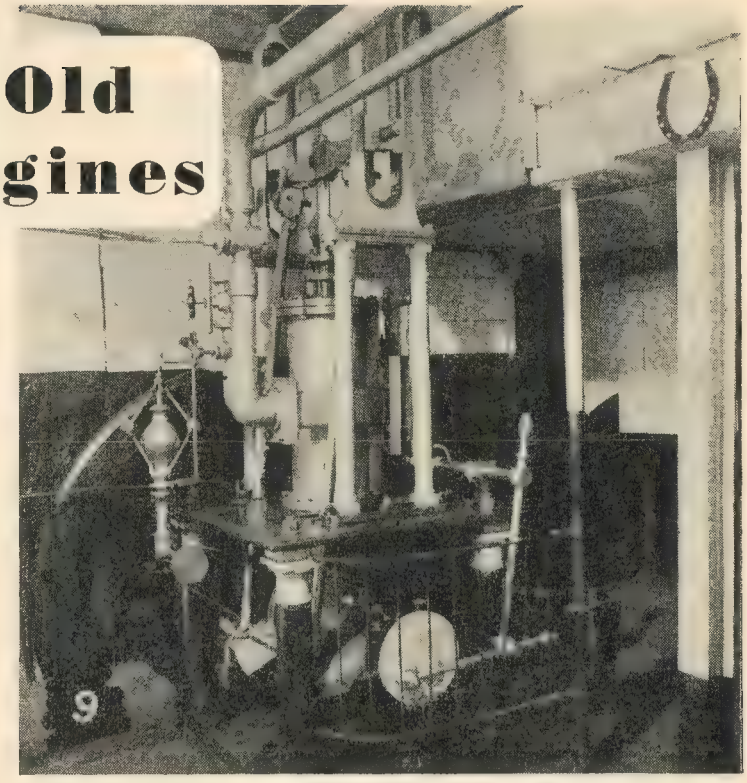
Unusual Old Steam Engines

DETAILS FROM AN ENGINE LOVER'S NOTEBOOK

By "Student"

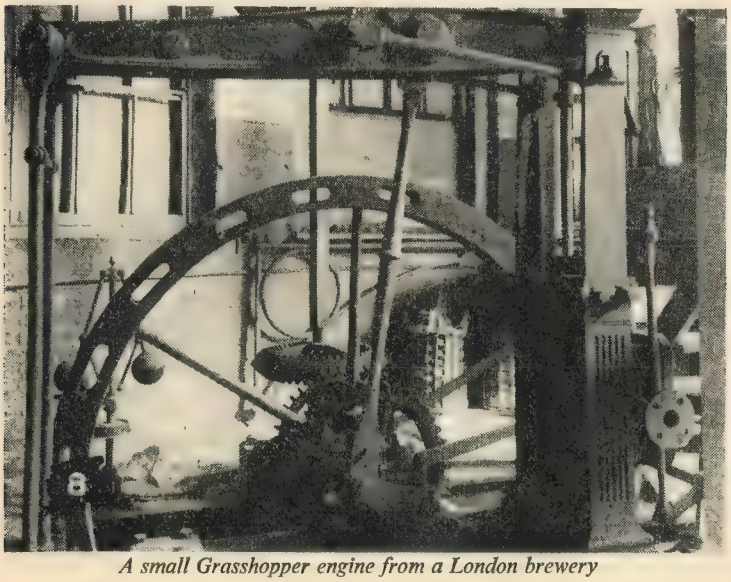
THE little grasshopper engine (Photograph 8) is from a London brewery, scrapped about 1945. As is usual in such a plant, despite the small size of the engine, it was coupled to all sorts of pumps, mash rouser, and also a hoist, each of which had its own independent couplings. The bore was a little over 6 in. and the stroke was 1 ft. 3 in., the steam pressure being 80 to 90 lb. per sq. in. in later years. Here, again, the side brackets for the parallel motion were from the floor, as in No. 7, but here, the flywheel arms are of wrought iron cast in, whilst the rear swinging columns are forged, and the connecting-rod had a very neat sweep, and centre boss. It would be over 80 years old, I believe, and was one of the uncommon cases where a vertical shaft drive was taken directly off the crankshaft by bevel wheels.

(*Continued from page* 212, *February* 25, 1954.)



A well-preserved table engine, also found in a brewery

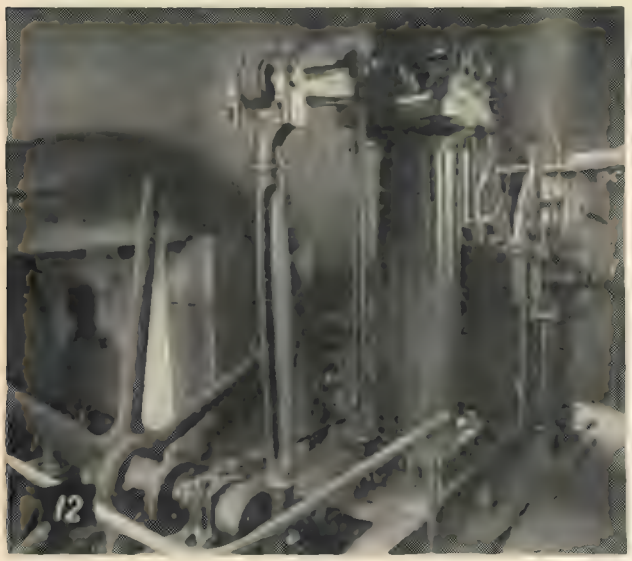
Photograph 9. As befits a brewery, this fine little table engine was in spotless condition, as was the rest of the plant. Of unknown make, it was non-condensing, slide-valve, 9 in. bore, and 2 ft. stroke. It had a double throw crank one for each side-rod, the valve being driven off a disc crank. The flywheel was 6 ft. in diameter, being a single casting with flat arms, the side-rods were 6 ft. 3 in. long, and the engine was some 9 ft. to the top.



A small Grasshopper engine from a London brewery

Photograph 10. This neat non-condensing slide-valve vertical once drove a corn mill, but this later became a chaff cutting, and fodder preparation plant for the pit ponies of a group of Notts, and Derbyshire collieries. Bore was about 8 in., stroke 1 ft. 6 in., age and make unknown. The fine forged pitch-fork connecting rod was 3 ft. 6 in. long, and there was a raised edge moulding upon the edge of the crank web, and the cross stays between the columns. The crank-shaft centre was 7 ft. from the floor and the flywheel, 6 ft. in diameter. The governor was unusual, in that it was driven from above by bevel wheels off the crankshaft.

Photograph 11. "Higginsons steam quartermaster," as it was called, built in the early 1880's was an early type of steering engine, having oscillating cylinders, frequently three in a large vessel, but



(10) *A vertical engine from a fodder preparation plant*

(11) *An early type of steering engine for a small ship*

(12) *A waterworks beam engine by Horn of Westminster*

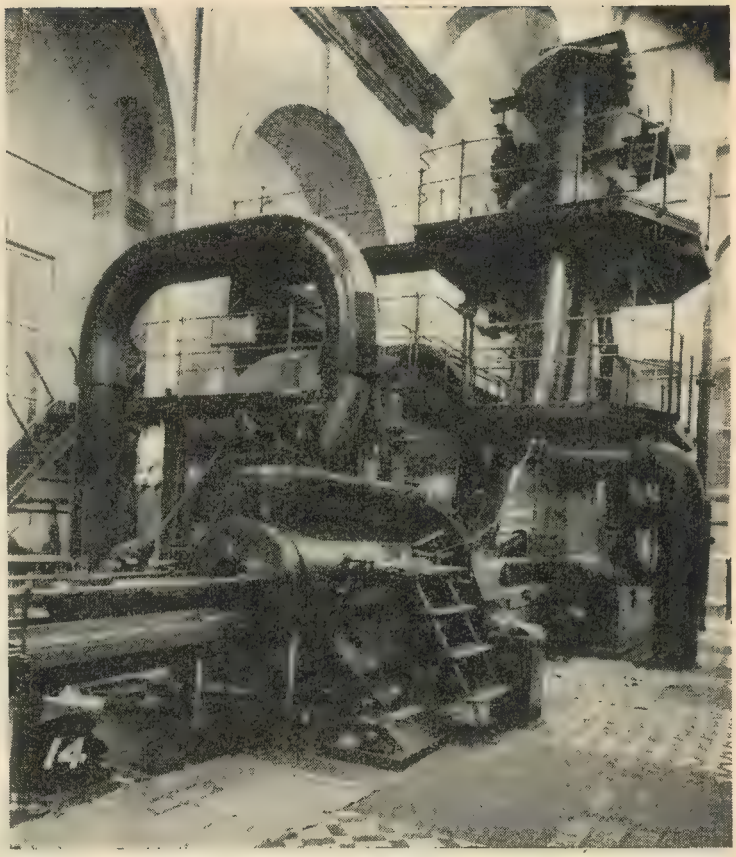
(13) *A vertical engine by J. & E. Wood of Bolton*

this one, being in a small ship, had only two. As can be seen, they drive the steering gear. They were port operated, and oscillated upon a ported bronze stub, at the end of the cylinder, which served as inlet and outlet for the steam. Being on a small ship, their size was in keeping, bore being 3 in., and stroke 4½ in. The trunnion centres were approximately 2 ft. 3 in. apart, the height, from trunnion centres to the crankshaft, being about 13½ in. It was the only one I ever saw.

Photograph 12 shows the older of two beam engines, made by Thos. Horn of Westminster installed in a Kentish waterworks. This one was in operation when the works were purchased in 1882, the other, almost identical, but having a forged connecting-rod, having been purchased new in 1885. This ran at full load until 1928, when the plant was electrified, the older one having been the standby. They were Woolf compounds, bores about 9 in., and 16 in., and crank stroke 2 ft. 3 in. The beams were 8 ft. long, and 1 ft. 3 in. deep, centres were about 8 ft. above the floor. Each drove a set of three throw pumps, through iron toothed gearing, the pump barrels were about 8 in. diameter, and 12 in. stroke. There were two Cornish boilers.

Photograph 13. This vertical, stated to be made by J. and E. Wood, of Bolton, was 27 in. bore and 3 ft. 6 in. stroke, date being about 1903. The connecting rod was 9 ft. centres, flywheel 15 ft. diameter, and crankshaft 11 ft. above the floor. The parallel motion beams were 8 ft. long, of cast-iron. It was of the plain slide-valve condensing type, and one feature was that the oil-catcher, near the top of the connecting-rod was forged solid with it. This engine was in a cotton mill in Shropshire, working in connection with a water turbine, but the premises had long been in other use.

Photograph 14. A lovely Manhattan engine built in 1914, for a Lancashire cotton mill; the makers were Geo. Saxon, of Openshaw, Manchester, and engine and house were a picture. The high pressure cylinder was horizontal, with drop valves, and was 27 in. bore, whilst the vertical low pressure of 54-in. bore had Corliss valves; the stroke was 4 ft. 6 in. The 40-groove flywheel was 22 ft. 6 in. in diameter and the top of the low pressure cylinder was 26 ft. above the floor. Designed horse-power was 1600, and it was very unfortunate that severe damage to the high pressure cylinder caused the removal of the engine recently.



A compound Corliss engine by Saxon, of Openshaw

READERS' LETTERS

(*Continued from page* 243)

VALVE DIAGRAMS

DEAR SIR,—There is not much doubt that many model engineers consider such things as valve diagrams quite unneeded complications; they have found by experience that they can "design" and make, for instance, a very satisfactory working model locomotive by rigidly following rules laid down by an acknowledged expert such as "L.B.S.C." and they argue, with a fair amount of plausibility, that all designing is just using common-sense and following rules, so why worry about diagrams?

Certainly, a type of designing can be done in this way, but the scope is very limited, as is soon found when something not covered by the rules is attempted; the would-be designer then discovers that he is stumped and must either appeal to the "maestro" for further instructions or set abou gathering some real knowledge for himself.

Unfortunately, it would seem that only too many model engineers are quite content to have their thinking done for them; but do not let us, therefore, ignore those with greater ambitions. Surely, it is better to encourage and help them as much as possible by providing accurate technical articles so that they may strike out on their own with a fair chance of success; mistakes are mostly the result of not knowing what one is doing. The followers of the "words and music" have no call to grumble; they do not need to read them and they are very well provided for otherwise.

Yours faithfully,

Bexhill-on-Sea. C. M. KEILLER.

IN THE WORKSHOP
BY DUPLEX

REDUCING-VALVE for the MINIATURE SPRAY GUN

AS mentioned in the previous article, the miniature spray gun there described gives better results with thin-bodied pigments when the pressure of the main air supply is reduced from 80 p.s.i. to a working pressure of some 10 p.s.i. The reducing-valve illustrated was, therefore, specially made for this purpose and it has been found to work well, besides being easy to operate under a variety of conditions. The principle followed is that adopted in the commercial reducing-valves designed for giving a low-pressure outflow from high-pressure gas cylinders.

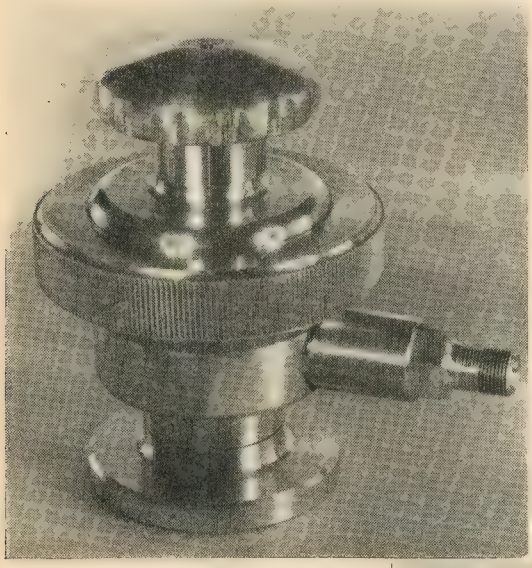


Fig. 1. *The finished reducing-valve*

The working of the reducing-valve can, perhaps, be best followed by referring to Figs. 2 and 3. The high-pressure air line is connected to the input union *K*, and the air is shut off by the rubber disc forming part of the thimble *H*. This thimble is suspended from a diaphragm *G* and its movement is controlled by an upper and a lower compression spring. If the pressure on the upper spring is increased by turning the adjustment-screw downwards, the pressure exerted by the lower spring on the sealing washer will be correspondingly reduced, so that air will flow into the main chamber and will then escape from the outlet at low pressure. If the low-pressure output is shut off or in any way restricted, the pressure building up in the main chamber, by acting on the air-tight diaphragm, will force the thimble upwards and, in this way, will cut off the high-pressure air supply. But as soon as the pressure in the chamber falls, the thimble-valve will open and, as a result, the pressure of the outgoing air will be maintained at a constant level.

In actual working, it was found that, on pinching the rubber tubing so as to shut off the air supply to the spray gun, the output pressure registered on the gauge rose by only ¼ p.s.i., and during normal working no variation of pressure was recorded.

Moreover, it was found that, even when the pressure in the main reservoir fell from 100 p.s.i. to 50 p.s.i., there was no appreciable fall in pressure of the air supply to the gun.

By adjusting the fluted finger-wheel, the pressure of the air supply to the gun can be varied over a range of from 0 p.s.i. to 10 p.s.i. with the particular pair of springs fitted.

Making the reducing-valve is mostly straightforward machining, but it is, of course, important to form air-tight joints, particularly on the high-pressure side.

The Base A

With the exception of the diaphragm, the parts of the reducing-valve were made of duralumin, in order to lessen the work of machining and to provide against any corrosion that might result from internal condensation. Aluminium and its alloys have a tendency to ball up on the point of the tool and form a false cutting edge that impairs the finish left on the machined work. But this adherence of the metal to the tool can be largely prevented by using tungsten-carbide tipped tools and a copious supply of cutting fluid. One advantage of these tipped tools is that any built-up edge formed can be readily removed with an oilstone slip, and there is then no danger of rounding the tool's cutting edge. To ensure accuracy of alignment of the mating

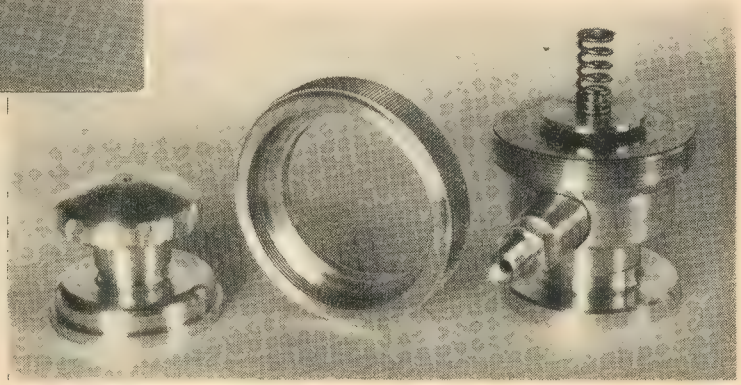


Fig. 4. *The cap removed to show the upper working parts of the valve*

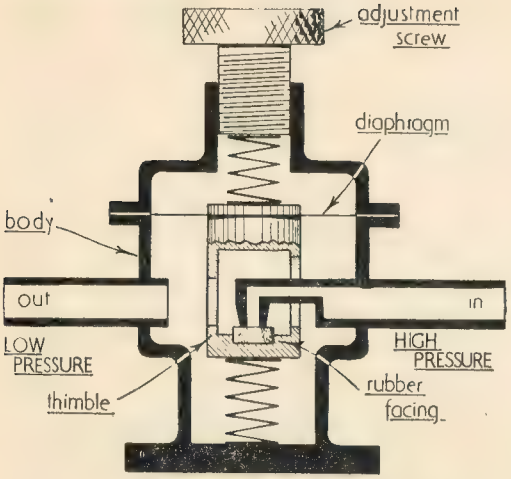


Fig. 2. Working diagram of a reducing-valve

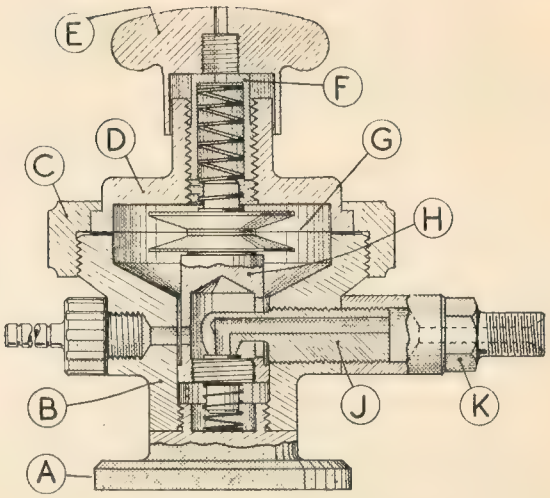


Fig. 3. Sectional view of the reducing-valve

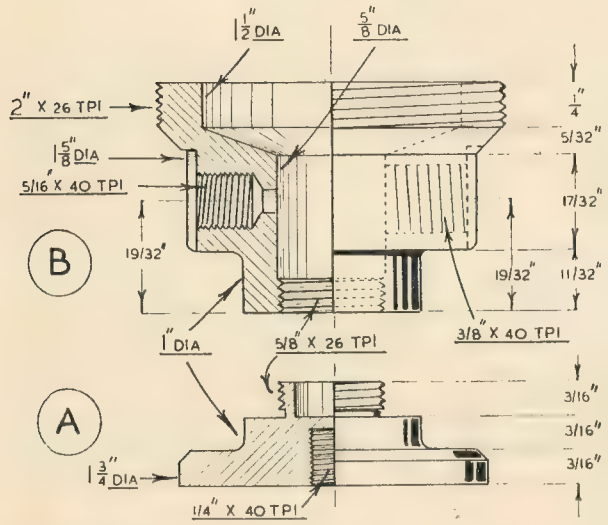


Fig. 5. The base A, and the body B of the valve

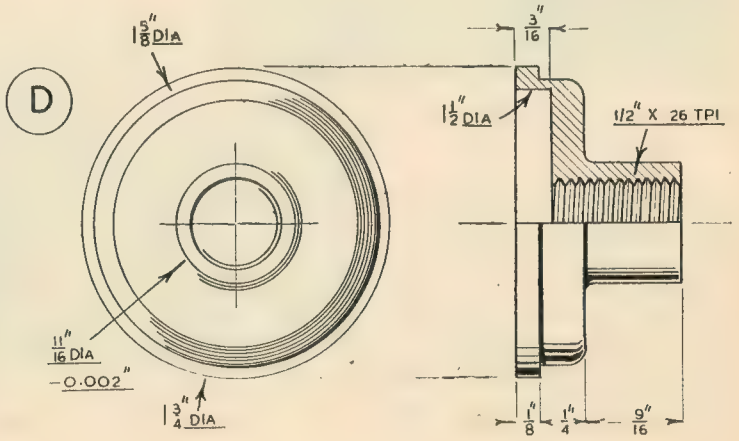
parts, all the larger threads were screwcut in the lathe, and for this work the new clutch unit fitted to the Myford ML7 lathe was found to be a great asset, and it enabled the screw threads to be cut with very little trouble. It will be noticed that, even for the larger diameters, fine threads have been used; for not only is this the usual practice in instrument work, but it also enables the machining to be more quickly carried out, as less metal has to be removed. The blind, threaded hole on the under side of the base is used for attaching the appliance to a wooden base.

The Body B

Again, this is mostly straightforward maching. But to ensure true axial alignment, the seating for the nozzle *J* is bored and tapped with the work mounted on an angle-plate attached to the lathe faceplate,

At the same time, the abutment face on the body should be machined flat, so as to provide an air-tight joint when the inlet union *K* is screwed into place. By turning the body through 180 deg. and reclamping it in place, the seating for the output union is machined in the same way or, if preferred, the body can for this purpose be mounted on a threaded stub mandrel screwed into the inlet seating. As shown in the drawing, the outlet seating is

Fig. 7. (Below) The valve cap



drilled through $\frac{1}{8}$ in. in diameter, so that during assembly, a guide-rod can be engaged in a corresponding hole in the thimble *H* to line up the components.

The Union Collar C

This was turned from a short length of $2\frac{1}{2}$ in. diameter duralumin rod, gripped in the self-centring chuck.

After the internal diameters have been machined and the screw-thread cut, the work is knurled with a pair of straight-tooth wheels. The knurling will be more easily carried out if a groove is first turned in the work to form a run-out for the knurls. The collar is now parted off, and then reversed in the chuck for finish-turning the upper surface.

The Cap D

This part must be accurately faced on its lower surface, so as to make an air-tight joint with the diaphragm against the upper surfaces of the body, and the outside diameters are turned to a close mating-fit in the union collar *C*.

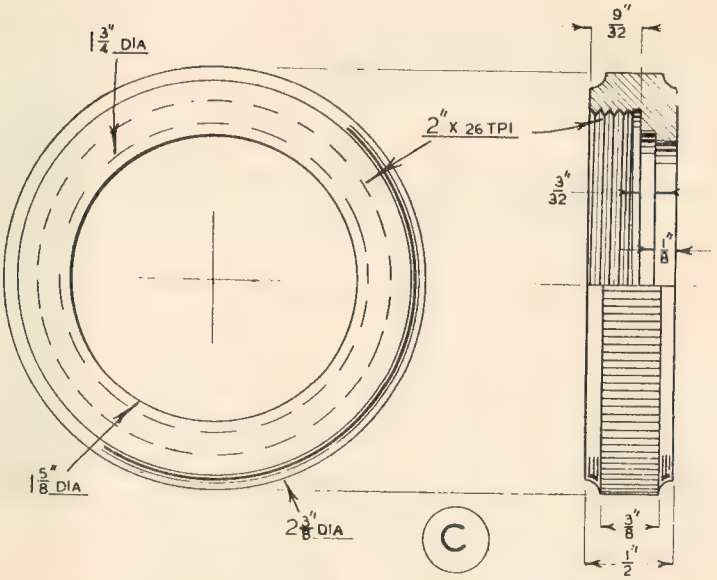


Fig. 6. The union collar

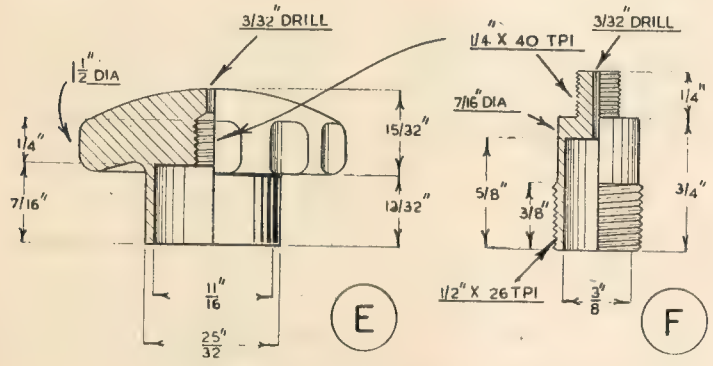


Fig. 8. E the adjusting-screw, and F the upper spring housing

The Adjustment-screw E

This knob will have a good appearance and will be easy to operate if the finger grip is either knurled or fluted. Straight knurling will be in keeping with the finish on the union collar, but if it is decided to flute the part, then a full description of the machining process will be found in a previous article, dated June 11th, 1953.

The Upper Spring Housing F

As shown in Fig. 3, this part is screwed firmly into the adjusting-screw, so that when this knob is turned, the housing is moved downwards, and increases the pressure on the spring. If it is found necessary, the parts can be further secured by fitting a grub-screw in one of the flutes.

It will be noted that a passage, 3/32 in. in diameter, is drilled axially through both the spring housing and the adjusting-screw; this forms an air vent and prevents any change of atmospheric pressure affecting the movement of the diaphragm.

(*To be continued*)

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Repairing Toothed Wheels

By H. H. Nicholls

THE processes used by clockmakers for repairing small toothed wheels, when one or more teeth are missing, are well known, but, depending upon soft-solder, they fail when one has to deal with wheels of larger size, and intended for heavier duties.

The alloy "Sifbronze" then becomes a most valuable aid, and the writer shows how this may be applied to some awkward work, especially in cases where tools of foreign origin are concerned, for which no replacements can be had, and one can justify the necessary time taken.

Fig. 2. Bevel wheel prepared for insertion of new tooth

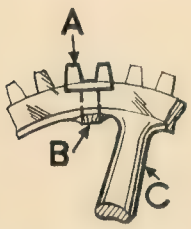

Fig. 1. Replacing two teeth

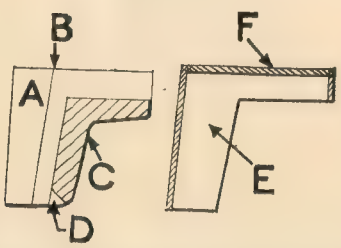

Fig. 3. Inserting new piece in bevel wheel

Take the wheel shown in Fig. 1, where we have a casting from which two teeth have gone, which are replaced by the piece *A* let into the iron casting.

Now the strength of such a repair can be vastly improved, if one takes a hint from the old millwright's "mortise" teeth, which were wooden teeth passing through the rim of the wheel and pegged at the back. In this case, the piece to form the repair is flame or saw cut to a "T" shape, put in the 4-jaw chuck and a round vertical part made, the turned portion going into a hole drilled in the wheel, the tail of the "T" proportioned to protrude about 3/32 in. from the casting, when inserted, and a fillet of "Sifbronze" run round it, the tail of the "T" thus immovably anchored being seen at *B*, Fig. 1. This being in addition to the fixing of the flat part of the "T" in the wheel, by running the alloy into the joint, while the "Sifbronze" will find its way along the whole stem of the inserted part, and the job will be as strong as, or stronger than, the original casting.

If, however, the location of the required repair should happen to be where a spoke occurs, the tail can be flat, and let into the side of the wheel; the way to do this will appear from the next example.

In Fig. 2 a bevel wheel is shown, from which a tooth had been broken out, and of American origin, for which a replacement could not be obtained.

First, let it be said, that such an article must be put in the vice between pieces of wood or lead, to avoid damaging the good teeth when the vice grips, and the boss of the wheel, where it is faced, must also be protected.

The photograph shows how a slot was made for a tail to the new tooth; referring to Fig. 3, on the left is seen the section of the bevel wheel casting, taken on the centre-line of the space prepared for the new tooth (cut from a piece of mild-steel).

At *A* is the elevation of a good tooth, running out to the rim of the wheel, to its full depth, *B*; the section hatched *C* is that part of the rim from which the space for the new tooth has been filed out, and *D* is a little triangular nick made with a file. Now these nicks serve a very useful purpose, in helping the

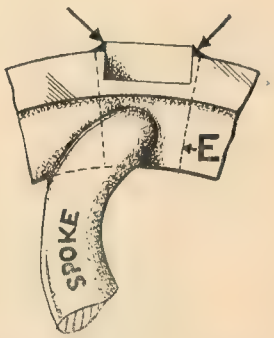

Fig. 4. Fillets of "Sifbronze"

"Sifbronze" into the joint, and are, of course, solidly filled when the job is complete.

(*Continued on next page*)

QUERIES AND REPLIES

"THE M.E." FREE ADVICE SERVICE. Queries from readers on matters connected with model engineering are replied to by post as promptly as possible. If considered of general interest the query and reply may also be published on this page. The following rules must, however, be complied with:

(1) Queries must be of a practical nature on subjects within the scope of this journal.
(2) Only queries which admit of a reasonably brief reply can be dealt with.
(3) Queries should not be sent under the same cover as any other communication.
(4) Queries involving the buying, selling, or valuation of models or equipment, or hypothetical queries such as examination questions, cannot be answered.
(5) A stamped addressed envelope must accompany each query.
(6) Envelopes must be marked "Query" and be addressed to THE MODEL ENGINEER, 19-20, Noel Street, London, W.1.

Rack Cutting

Can you recommend a practical method of cutting a 40 d.p. rack in the lathe, or refer me to some source of information on the subject? I have an M.L.7 lathe with all the usual equipment available, plus gear-cutting equipment, including dividing heads and cutters, etc. I also possess most of the P.M. publications dealing with gears and gear cutting.

J. C. (Yeovil).

It is possible to do this fairly satisfactorily by using the leadscrew to measure the circumferential pitch of the rack, but if a rack of any considerable length is required, there is often great difficulty in finding sufficient room to traverse the rack to the distance required without fouling either the lathe chuck or tailstock.

Attachments have been made in which a cutter spindle carrying the gear cutter is mounted at right-angles to the lathe axis and the work traversed by the cross-slide; thus, although the traverse of the cross-slide is limited, it is possible, by working in stages, to cut a rack of practically unlimited length.

The circular pitch for 40 d.p. is 0.0785 in., and this represents the distance the rack must be traversed between each cut. A cutter having an included angle of 29 deg. is usually employed for involute gears, the thickness of the teeth on the pitch line being 0.393 in. and working depth of teeth 0.05 in., the full depth, including tip clearance, being 0.0539 in.

"Kiwi" 15 c.c. Engine

I am constructing the "Kiwi" 15 c.c. 4-stroke engine from the "M.E." drawings, and would be very pleased if you could answer the following questions regarding this engine:—

(1) *Where could I obtain the parts for Atomag Minor H.T. Magneto, including the magnet, wire, condenser, etc., also the sparking-plug?*

(2) *Can you recommend a good book suitable for the beginner on the subject of magneto construction?*

(3) *If I am not able to make the magneto, where could I obtain a finished one?*

(4) *If I run the engine as a stationary engine, what h.p. can be expected at moderate speeds?*

(5) *Would a drip-feed lubricator fitted to the front main bearing supply the whole engine?*

T.McM. (Coleraine, Co. Derry).

(1) The materials for constructing the Atomag Minor H.T. Magneto can be obtained from Roox Products, Wellhouse Road, Beech, Alton, Hants.

(2) The only book we know of which would be likely to help you in the construction of the magneto is our handbook *Ignition Equipment*, price 8s. 6d.

(3) The "M.I." miniature magnetos can be obtained from Electronic Developments (Surrey) Ltd., 18, Villiers Road, Kingston-on-Thames, Surrey.

(4) If you propose to use the engine for stationary work, it should be run at moderate speeds, and unless converted to water cooling, it is desirable to fit a fan blower to ensure that the cylinder is kept cool. In the circumstances, we think that it would be possible to obtain ¼ h.p. from the engine on continuous running, at 3,000 r.p.m. but we would point out that engines of this type are not really intended for running for very long periods, as the weight of the engine is cut down, with consequent reduction of bearing areas, and its primary use is for light-weight boats and similar purposes where it is not necessary to run the engine for very long periods.

(5) A drip-feed lubricator fitted to the front main bearing, as stated, would keep the engine adequately lubricated.

Gold plating

I wish to gold-plate some watch cases and should be glad to know if it is possible to do this by electro-plating. If so, can you please tell me the procedure, and where to obtain the materials? Failing this, can I do the job by chemical plating, and can you recommend any books on the subject?

G.W.B. (Rushden).

The only practicable method of gold-plating watch cases, in our opinion, is by electro-plating. Our handbook, *Electro-plating for the Amateur*, price 5s. 0d., gives general information on plating in various metals, and will be found to give most of the practical information required.

Materials for electro-plating can be obtained from W. Canning & Co. Ltd., 77, St. John's Street, Clerkenwell, London, E.C.1.

We do not know of any method of chemical plating which could be relied upon to give sufficiently permanent results for your purpose.

REPAIRING TOOTHED WHEELS

(*Continued from previous page*)

At the right of Fig. 3 is the appearance of the piece to be put in, *E*, while the shaded part *F* is an extra allowance to be made, so that the job can be brought to a perfectly flush and satisfactory finish. The piece *E* is, naturally, roughly shaped like the tooth blank, and the new tooth made by filing very carefully, until its profile is perfectly formed.

Fig. 4 shows how, when a piece to be inserted is made to stand proud of its surroundings, before being filed or ground down, it offers opportunity for the fillets indicated by the arrows to form, and these lead the "Sifbronze" to the proper place, and then right into the joint, not spreading over the job in a mess, and leaving the vertical joint dry, instead of being thoroughly permeated by the molten alloy. This is the front of the wheel shown in Fig. 2, the bevel teeth being cut upon its back. Note how the piece *E* must be tapered to follow the radial teeth. When this wheel and the new piece were taken to a welder for the "Sifbronze" to be applied, a perfect job resulted, the casting being, of course, properly heated up before "Sifbronze" was applied.

WITH THE CLUBS

Norwich and District S.M.E.

Past and present members are cordially invited to attend the next meeting of the society to hear about its reorganisation on informal lines.

The meeting will be held at the Assembly House, Theatre Street, Norwich, on the second Wednesday in March, i.e., March 10th, at 7.30 p.m.

Come and renew old acquaintances in an atmosphere of model engineering and talk "shop." Membership free!

Hon. Secretary: MR. A. A. TAYLOR, 150, Furze Road, Thorpe St. Andrew, Norwich.

International Radio Controlled Models Society

Birmingham Group. Saturday, March 6th, at 2 30 p.m., at the Birmingham International Centre, Suffolk Street, Birmingham. Mr. J. Merrick will speak on "A Reliable Receiver." Saturday, April 3rd, Mr. H. Croucher will speak on "Preliminary Experiments with Aircraft."

London Group. Sunday, March 14th, at 2.0 p.m., at the Horseshoe Hotel, Tottenham Court Road, Mr. R. F. Stock will demonstrate a radio-controlled model land vehicle.

Tyneside Group. Friday, March 26th, at 7.30 p.m., at the Y.M.C.A., Blackett Street, Newcastle-on-Tyne, (note change of meeting place). Discussion on "Intergear."

Manchester Group. Thursday, March 11th, at 7.30 p.m., at the Milton Hall Deansgate, Manchester. Annual general meeting.

Hon. Secretary, C. H. LINDSEY, 55, Tenison Road, Cambridge.

Aylesbury & District S.M.E.

On January 20th, the society met at Hampden Buildings for its seventh annual general meeting. As usual the a.g.m. is the time for electing officials :—Our president Mr. E. D. Eborn, was re-elected, as were our vice-presidents, Mr. F. R. Forest and Mr. H. East. Mr. Forest was re-elected chairman. Mr. E. Smith was re-elected secretary and with it will go the offices of treasurer and scribe. The committee is the same as 1953, namely: C. Gill, N. Gower, C. Horwood, E. Burch and E. Bide.

Mr. Forest was again elected to put the club interests at meetings of the Aylesbury Association.

Hon. Secretary: E. H. SMITH, Mulberry Tree Cottage, Devonshire Avenue, Amersham, Bucks.

Sussex Miniature Loco Society

The annual general meeting was held on Saturday, January 23rd, 1954, when members attended from as far apart as Hastings, Worthing, Horsham, and London. Mr. L. Whittington was elected chairman, Messrs. H. Brown and A. E. Ayliffe being elected vice-chairmen. Last year's committee were re-elected.

It is hoped to have the opening ceremony the first week-end in May, and fuller details will be issued in due course.

Prior to the meeting, Mr. Cornwell's *Lassie* from Hastings, ran on the completed portion of the track, and Mr. Brown ran his 5-in. gauge "Hall" on the Sunday morning.

Hon. Secretary and Treasurer: S. R. BOSTEL, Bostel House, 8, Cranbourne Street, Brighton, 1.

Harrow & Wembley S.M.E.

At our next meeting on March 10th, at 7.30 p.m. Mr. Boff will give a lecture on his experiences with full scale locomotives.

On March 17th, at 7.30 p.m., a locomotive section meeting will be held, when members are asked to bring along their "bits and pieces" under construction.

Visitors will be welcomed to these meetings at the society's headquarters, Heathfield School, College Road, Harrow (opposite Harrow-on-the-Hill Station).

Hon. Secretary: K. D. CARTER, "Hedgely," South Approach, Moor Park, Northwood.

There is a very strong locomotive section in the Macclesfield and District Society of Model Engineers. In this photograph, taken by the hon. secretary, Mr. A. Chadwick, we see the Vice-chairman, Mr. D. S. Foster, preparing his North Eastern "R1" 4-4-0 engine, the result of three years' work, for its first steam trial. To the right is Mr. W. Tucker with his North Eastern "V" class Atlantic.

Eltham & District Loco Society

The next meeting will take place at the Beehive Hotel, Eltham, at 7.30 p.m., on Thursday, March 4th, when the chairman, Mr. Hutton, has promised to bring along the chassis of his 3½-in. gauge locomotive, through the kindness of Mr. Overton in supplying transport. Members should make a special effort to attend this session, as this beautiful piece of craftsmanship should be seen by everybody. Mr. Hutton will give a talk on the general construction during the evening.

At the last meeting the society had a very cosy fireside discussion on various topics, including Mr. A. Brock's splendid tender chassis for his 5-in. gauge "Adam's" locomotive, which is coming along nicely. Visitors are always cordially welcomed to the meetings.

Hon. Secretary: F. H. BRADFORD, 19, South Park Crescent, S.E.6.

The Junior Institution of Engineers

Friday, March 5th, at 7.0 p.m. Townsend House, Greycoat Place, S.W.1. Film evening: "A Tractor is Born"; "Tractor Testing"; and "Precision and Practice." (Ford Motor Co. Ltd.)

North Western Section. Monday, March 8th, at 7.30 p.m., at the Engineers' Club, Albert Square, Manchester. Election of officers. Film evening.

Sheffield and District Section. Monday, March 8th, at 7.30 p.m., Livesey Clegg House (opposite Union Street Cinema), Sheffield. Ordinary meeting—Paper: "The Use of High Frequency Heating in the Metallurgy Industry," by J. B. Ingall. (Electric Furnace Co. Ltd.)

Friday, March 12th, at 7.0 p.m. Townsend House, Greycoat Place, S.W.1. Ordinary meeting—Paper: "Boiler Water Treatment," by W. F. Gerrard, F.R.I.C.

Sheffield and District Section. Monday, March 15th, at 7.30 p.m., at the Royal Victoria Hotel, Sheffield. Special meeting: "Developments and Future Possibilities in Electricity Generation," by Sir John Hacking, M.I.E.E. (president of the Institution).

Friday, March 19th, at 7.0 p.m. Townsend House, Greycoat Place, S.W.1. Informal meeting. Paper—"A Review of Plastics Piping," by B.T.A. Holland.

North Western Section. Monday, March 22nd, at 7.30 p.m., at the Engineers' Club, Albert Square, Manchester. Special meeting—"Developments and Future Possibilities in Electricity Generation," by Sir John Hacking, M.I.E.E. (president of the Institution).

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This Week's Lathe Bargain Offer: Myford "M.L.7" lathe, used few hours only, faceplate, 7 changewheels, 6" independent chuck, on angle steel stand, drill chuck, square centre, tailstock adaptor, ½" dia. boring bar and Wimet cutter, 4 faceplate dogs, 3 carriers, set of 12 Wimet lathe tools, today's value £63 10s. Our Price £48 10s., or £12 10s. deposit and 12 monthly payments of £3. Order now from—CORBETT'S (LATHES & TIPPED TOOLS), Stanton Hill, Sutton-in-Ashfield.

Shelby Tool & Engineering Co. Ltd., have made a purchase of a large assortment of new tools for the woodworker, engineer, builder, etc., mostly in original wrappings; bargain prices to clear, send 6d. for lists.—SHELBY TOOL & ENGINEERING CO. LTD., Annesley, Woodhouse, Notts.

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Drills, H.S.S., 30 mixed 1/32-3/16 (used), 6s. 6d. Taps B.S.F., Whit., B.A. metric l.h. and r.h. threads, mostly new, 24 mixed, 6s. 6d.—MARCHANT, 30, Loretto Gardens, Kenton, Harrow, Middx.

E-W Lathe, B.G.S.C., 4" Burnerd ind. countershaft, pedestal feet, boring table, gear guard, milling cutters, £18, or exchange astronomical telescope.—MR. R. MORGAN, 24, Ty-Coch, Cwmbran, nr. Newport, Mon.

Drummond Lathe 4" round bed, s.c., with stand, motorised, 1/3 h.p., a.c., countershaft and treadle, well equipped, £25.—EDWARDS, 43, Alexandra Road, Farnborough (Hants) 1096.

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Jacobs ⅛-½" **Chuck,** new, £1. Ditto 0-⅜" s/h., 2 M.T., 10s. Champion No. 1 with chuck, £3. M.L.7 cut-off slide, £6.—Box No. 7189, MODEL ENGINEER Offices.

Executors Selling Entire Contents enthusiast's modelling workshop. S/c lathes, drills, facers, wheelcutters. Large quantity superior gauges, tools, materials. Complete or lotted. View by appointment.—CANN, Bouverie Hotel, Folkestone.

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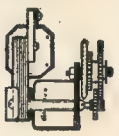

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Abrasive Discs, 5" diam. asstd. doz.	3/9
Green Grit Wheels 3" x ½" x ½" bore	4/9
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Bevels, 2 to 1 ratio. 3" and 1½" diam. brass. Pair	5/9
Solder Paint. Per jar	3/6
Mains Transformers, 24 volt, 12 v 3 amp	25/-

May we send our 300 item list? 1½d, stamp please.

4" Exe Treadle S.C. Lathe including 3" and 4" 3-jaw chucks 5", 4-jaw. All accessories. New condition, £60. Offer.—MRS. BEST, 60, Albion Road, Birchington, Kent.

For Sale. Drummond lathe, 4" S.C., stand treadle, 3-stage flywheel, accessories. Good condition, £18 10s., o.n.o.—113, Cheston Avenue Shirley, Surrey.

Geo. Adams 2½" Precision Lathe on stand with countershaft and ¼ h.p. G.E.C. motor, fitted 7 crawford collets ⅛" to ½" and Burnerd 2¾" s.c. chuck. Completely overhauled, new screws to slide-rest, chrome handles. A really first-class outfit, £45.—BOWYER-LOWE, 12, South View, Letchworth. Phone: Letchworth 34.

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THRUST RACES.—13/16 in. x ⅝ in., 1/6
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Suitable set for all trades

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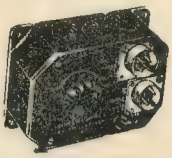

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Borough of Torquay. Miniature Railway. The Corporation are desirous of hearing from parties interested in any or all of the following aspects of a 7½" or 9½" gauge miniature passenger-carrying railway of some half-mile in length, situated in the Recreation Ground and King's Gardens areas at Torquay.

1. The construction of the track from formation level.
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For Sale. 1½" scale traction engine.—COLQUHOUN, Basement Flat, 9, Old Southend Road, Southend-on-Sea.

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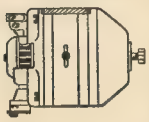
Rustless Alloy Rail. Flat bottom Gauge 0-10½". All sizes ex-stock.—FENLOW, PRODUCTS LTD., Weybridge, Surrey.



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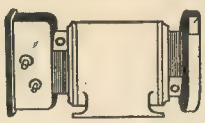

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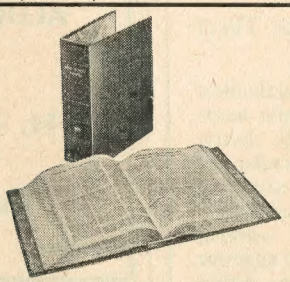

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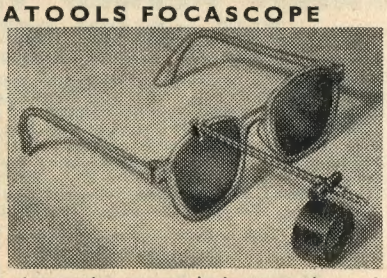
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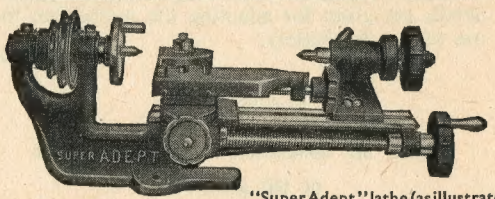

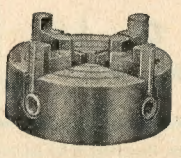
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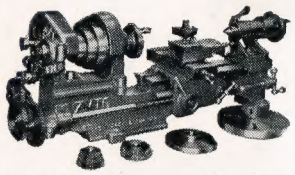

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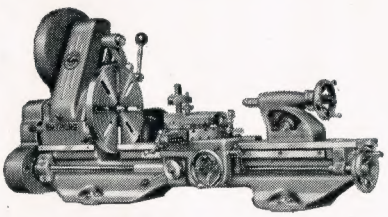

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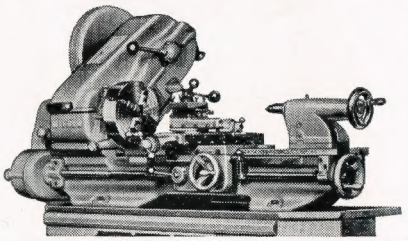

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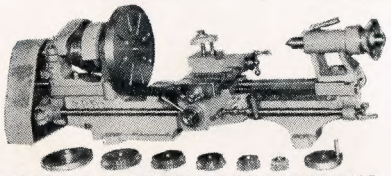

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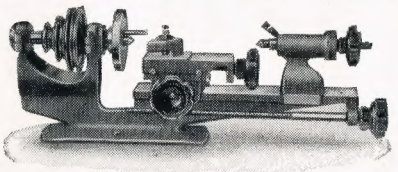

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